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ABSTRACT

This mathematics peer-tutoring program offers students an opportunity to seek help with specific mathematical difficulties from peer-tutors. The program is designed to free faculty to offer outside-of-class help to students who are experiencing extreme difficulty in understanding concepts. In addition, the tutors are available to offer help during the evening when faculty are not usually available. The training program is designed to train tutors to use procedures which take advantage of the unique tutor-tutee relationship. The program emphasizes the establishment of an atmosphere to promote learning and a teaching strategy that concentrates on student involvement. (MP)

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A TRAINING PROGRAM FOR STUDENT MATHEMATICS TUTORS

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by

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May 1978

SE 026 977

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A B S T R A C T

The mathematics peer tutoring program at Cobleskill offers the students an opportunity to seek help with specific mathematical difficulties from peer-tutors. The program is designed to free faculty to offer outside-of-class help to students who are experiencing extreme difficulty in understanding concepts. In addition, the tutors are available to offer help during the evening when faculty are not usually available.

The training program is designed to train tutors to use procedures which take advantage of the unique tutor-tutee relationship. The program emphasizes the establishment of an atmosphere to promote learning and a teaching strategy that concentrates on student involvement.

The tutoring program (including the training program) was initiated in the Fall, 1977 semester. An evaluation of the program and recommendations for program improvements are included in the report.

PREFACE

The training program described in this report was initiated during the Fall, 1977 semester at Cobleskill. Although the training program is designed to meet the need of the tutors at Cobleskill, it can serve as a model for training programs at other colleges.

The main purpose of this report is to present a training program for student mathematics tutors. However, it is felt that the development of the program will be more meaningful if the reader has a general understanding of peer-tutoring programs. Hence, Chapters 1-5 are included.

The exercises included in the training program are meant to stimulate certain types of activities. The specific exercises are not a crucial part of the program. It is the intended outcomes that are important. Hence, the exercises may be modified by other trainers.

A special thank-you is given to Peter Lindstrom (Genesee Community College), Gerry Lieblich (Bronx Community College), and Ann Cohn (Corning Community College) for the stimulating ideas that they offered during visits to their colleges.

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CHAPTER 1

INTRODUCTION

Introduction

When a college education was either for the wealthy or academically talented student the traditional starting point for the study of college mathematics was either precalculus (college algebra) or calculus. This is no longer the case. To meet the needs of an increasing number of mathematically deficient students who are now enrolled in post-secondary school programs, many colleges (especially two-year colleges) include courses in arithmetic, elementary algebra, and intermediate algebra in their mathematics curriculums. At the same time that schools have been opening their doors to students who require a high level of personal attention, financial constraints have greatly restricted the schools' educational resources. To overcome this apparent dilemma many educators have turned to an untapped resource for help; the students at their schools.

Using peer-tutors to help students learn is certainly not a new idea. Students have always assisted their friends with their school-work. What is new, is the formally organized peer-tutoring programs that have recently become popular. The programs were first developed at the elementary and secondary levels during the 1960's (see Gartner, et. al., 1971) and at the college level in the early 1970's (see Goldschmid, 1976 and Reed, 1974).

While quantitative evidence of the success of peer-tutoring programs is lacking, subjective indications are that the programs as a whole are meeting with overwhelming success. (For example, see Elliot, 1973; Klaus, 1975; Reed, 1974 and Thelan, 1969.) The programs are thought to benefit both the tutee and the tutor. The tutee receives individualized instruction in a noncompetitive situation, while the tutor, in addition to any direct compensation that he may receive, can gain in both self-esteem and subject-matter knowledge by helping others to learn.

The types of tutoring programs that have been developed are quite varied. Each has been established to provide for specific needs and to meet specific objectives at a specific institution. The programs range from very structured settings where tutors act as a teacher's aide in a regular classroom session or conduct formal lessons where new material is taught, to the rather informal program where tutors are available to students who seek their help with course-related difficulties.

Successful peer-tutoring programs have been found to share common components (Cohn, 1977; Gartner, 1971; Klaus, 1975; Lieblich, 1977 and Reed, 1974). These components are summarized in Table 1.

TABLE 1

ESSENTIAL COMPONENTS FOR PEER-TUTORING PROGRAMS

1. A clear objective.
2. A total (that is, administration, faculty, tutors, and general student body) institutional commitment to the objectives.
3. A skilled program director to supervise the tutors and the general tutoring program.
4. Adequate facilities and financial resources.
5. Knowledgeable and empathetic tutors.
6. Provisions for adequate direct tutor compensation.
7. A well-developed tutor training program.
8. A program that does not force tutee participation.
9. A program that offers clear alternatives to the instructional methods used in the classroom.
10. Workable tutor-tutee ratios (preferably one-to-one).
11. An evaluation program.

A Statement of Purpose

Experienced educators recognize a tutor training program as an essential component of a peer-tutoring program. The primary purpose of this project is to prepare a trainers manual that contains instructional materials for a tutor training program for mathematics tutors. The instructional materials are directed toward the specific objectives set for the peer-tutoring program at the State University of New York, Agricultural and Technical College at Cobleskill, New York (a public two-year college hereafter referred to as Cobleskill). A secondary

purpose of the project is to provide a trainers manual that other educators can modify and use.

If the reader is to adapt the instructional strategies and content in the manual to fit his particular needs, he should appreciate the rationale for their inclusion. This appreciation is based upon a knowledge of the relationship of Cobleskill's program to the various types of peer-tutoring programs that have evolved in higher education. A broad overview of programs, suggested benefits, and alternatives for components are presented in Chapter 2.

Chapter 3 presents a summary of the peer-tutoring program at Cobleskill. Chapter 4 presents background information on the components of the training program and how each component relates to the attainment of the objectives set for the Cobleskill tutoring program. The evaluation of the implementation of the program during the Fall, 1977 semester, as well as some recommendations for program improvements are included in Chapter 5. Appendix A includes forms that are used in the Cobleskill program and Appendix B is the trainers manual.

CHAPTER 2

PEER-TUTORING PROGRAMS

Program Objectives

The first component that must be specified when building a peer-tutoring program is the program objectives. Each of the other components are then determined in relationship to these objectives. A summary of suggested program objectives is listed in Table 2.

TABLE 2

TUTORING PROGRAM OBJECTIVES

1. Academic support to improve achievement in specific courses.
2. General support to overcome deficiencies in basic skills areas such as reading and arithmetic.
3. Support to improve general study skills.
4. Support in socio-psychological areas such as self-confidence and self-esteem.
5. General counseling to overcome personal problems.
6. Counseling for college adjustment.

Types of Peer-Tutoring Programs

The type of peer-tutoring program that is selected for development at a particular school depends upon the objectives set for the program and the type of instructional program that exists at the school. Goldschmid and Goldschmid (1976) present the following peer-tutoring models to illustrate the wide range of programs that have evolved in higher education.

1. Discussion Groups, Seminars or "Tutoria" Led by Teaching Assistants

   In large universities it is common practice to conduct introductory or survey courses using a large lecture-discussion group approach. A faculty member presents the lectures and a teaching assistant (usually a graduate student) conducts weekly small-section group meetings. The purpose of the small-section meeting is to discuss material presented in the lecture, to allow students to ask questions, to allow students to solve problems and receive immediate feedback, and to review.

   Cornell University uses a lecture-discussion approach to teach introductory psychology to 1,200 freshmen annually. The peer-tutors used in the program are undergraduate students who have completed the course with a grade of A. Maas and Pressler (1973) report that the results of the program have been very positive.

2. The Proctor Model

Individualized instruction has become a popular instructional strategy in higher education in the past few years. The programs, modeled after the "Keller Plan" (Keller, 1974), allow students to study individually prescribed course raterials at their own rate and to take tests on units or modules when they feel prepared. A key element in the program is the student proctor (tuter) who, under the direction of the course instructor, individually helps students learn course materials. In addition, the proctors aid the professor with bookkeeping chores and administering and correcting tests.

Bronx Community College in New York City uses a variation of the Keller Plan to teach its developmental mathematics program. Lieblich (1977) reports that the program has been helpful in teaching mathematics to students who enter college with a wide range of mathematical deficiencies.

3. Student Learning Groups

Cohen (1977) uses a small-group approach to teach elementary algebra to two-year college students at the State University of New York, Agricultural and Technical College at Cobleskill, New York. Individual classes of from 25 to 35 students are divided into groups of three or four and members of each group study together and help each other solve problems. The

instructor only helps when it appears that his help is necessary. Each member of a group acts as a tutor when he helps a groupmate learn the course content. Student evaluations of the course indicate that the small-group approach is an enjoyable and efficient pedagogical strategy.

4. The Learning Cell

Goldschmid (1971) describes the learning cell as a student dyad in which pairs of students read and prepare questions on commonly read course materials and then alternate asking and answering questions in a regular classroom session. The instructor helps when problems arise. Goldschmid used the learning cell method to teach a large psychology course (250 students) and found it to be effective.

5. "Parrainage" or Student Counseling

The final form of peer-tutoring described by Goldschmid and Goldschmid (1976) takes place outside of the formal classroom setting. Educationally mature students (parrains) are assigned to new college entrants to act as counselors and course-related tutors.

Cohn (1977) coordinates a peer-tutoring program that is a form of the parrainage system at Corning Community College in Corning, New York. Peer-tutors are available to counsel students with personal problems, to help them learn and practice efficient

study methods, and to help them with course-related problems.

The final two forms of peer-tutoring described in this chapter are the teacher aide and the remedial tutor. They are not specifically described by Goldschmid and Goldschmid (1976), although they might be considered as forms of the proctor model and parrainage system, respectively.

6. Teacher Aide

Teachers frequently find it effective to have their students practice course-related skills at their seats in a classroom setting. The teacher can then help students individually with problems. A peer-tutor can be employed in this setting to also help students individually.

7. Remedial Tutoring

The main objective of remedial peer-tutoring is to help students overcome course-related difficulties. In one form of remedial tutoring, peer-tutors are based in a remedial learning center and are available to help their peers with classroom-related difficulties either on a walk-in or by appointment basis.

Remedial peer-tutoring programs are conducted at Genesee Community College in Batavia, New York (Lindstrom, 1977) and at Cobleskill Ag-Tech College. In each of these programs students seek help with their

mathematics assignments mainly on a walk-in basis. The program at Cobleskill will be described fully in the next chapter.

In a second form of remedial tutors, peer-tutors are assigned to "shadow" a "high-risk" student and work with him individually on course-related difficulties throughout the semester. The shadow method of remedial tutoring is used in the Educational Opportunity Program at Cobleskill Ag-Tech College.

Alternatives for Program Components

In addition to the program objectives and the type of peer-tutoring program that is used to accomplish the objectives, a program developer must choose among alternatives for certain essential program components. After the choices are made, the tutors can be trained and the program can be implemented.

Criteria for Tutor Selection

Although Reed (1974) found that the most popular criteria for selecting tutors in higher education is academic ability, Rauch (1969) and Gartner (1971) suggest that the best criteria for selecting peer-tutors is their genuine interest and commitment for tutoring. Table 3 presents a summary of selection criteria that have been suggested by Reed (1974), Rauch (1969), Gartner (1971), and Goldschmid and Goldschmid (1976).

TABLE 3

CRITERIA FOR TUTOR SELECTION

1. Academic ability as shown by achievement in the course content to be tutored or by faculty recommendation.
2. An expressed interest and commitment for tutoring.
3. Demonstrated sensitivity, understanding, and the ability to relate to peers.
4. A need for the compensation given to tutors.
5. The attainment of a certain status in the school, such as a member of a service organization.

Tutor Compensation

Although peer-tutors may have altruistic motives for wanting to be tutors, Reed (1974) suggests that tutors need to receive some form of concrete compensation in order to maintain a serious interest in their work. Reed found that by far the most popular form of tutor compensation is financial. Mathieu (1972) suggests that students can also be justifiably compensated by academic credit. The rationale for giving academic credit for tutoring is based upon the hypothesis that students learn through tutoring. Tutors, under formal supervision, have practice in developing their communication skills, attitudes, and interpersonal relationships. In addition, tutors develop an awareness of teaching problems and competence in teaching techniques. Volunteer tutors can be indirectly compensated by being given special status or special recognition in the school.

A summary of types of tutor compensation is given in Table 4.

TABLE 4

TUTOR COMPENSATION

1. Financial.
2. Academic credit.
3. Special status or recognition.
4. No compensation other than the inner satisfaction gained from helping others learn.

Program Entry Criteria for Tutees

In some types of tutoring programs students become tutees due to the fact that they are enrolled in a course that regularly uses peer-tutors. Entry criteria for other types of tutoring programs are given in Table 5.

TABLE 5

ENTRY CRITERIA FOR TUTEES

1. Voluntary.
2. Faculty or counselor referral.
3. Mandatory for students with a low level of achievement in a course.
4. Mandatory for students with low scores on a standardized test.

Of the criteria listed in Table 5, Reed (1974) found voluntary entry to be the most popular. Furthermore, he suggests that voluntary entrance into a tutoring program increases the probability for a positive tutor-learner relationship.

Tutor-Learner Ratios

Klaus (1975) suggests that peer-tutoring can enhance learning because it provides an alternative to the type of instruction that is offered in the traditional classroom setting. A major attribute of the alternative procedure is the close personal attention that can be enjoyed by the learner. Hence, anything other than a one-to-one tutor-learner ratio may negate the benefits that can be received from the program. Tutor-learner arrangements are listed in Table 6.

TABLE 6

TUTOR-LEARNER ARRANGEMENTS

Type of Tutoring	Tutor-Learner Ratio
1. Individual Tutoring	1:1
2. Small-Group Tutoring	1:2 to 5
3. Discussion or Review Classes	1:whole class

Physical Facilities

To maximize the value of tutor-tutee interaction, tutoring should be conducted in an atmosphere that can enhance learning. For tutoring programs that are not based in a classroom setting, a well-lighted, attractive, centrally located learning center, staffed by an adequate number of tutors who are available during convenient hours (such as evenings and weekends), is an ideal arrangement. Such a learning center might also include reference materials, teaching machines, and calculators. A summary of tutoring locations is given in Table 7.

TABLE 7

TUTORING LOCATIONS

1. Dedicated learning center.
2. Available classroom.
3. Secluded area of the library.
4. Dormitories or private residences.
5. Available areas on campus.

Scheduling Tutor-Learner Interaction

A summary of tutor-learner scheduling arrangements is given in Table 8.

TABLE 8

SCHEDULING ARRANGEMENTS

1. Interaction is regularly scheduled as part of a course.
2. Interaction is scheduled with either a single tutor or various tutors over an extended period of time by request or assignment.
3. Interaction is scheduled on a single appointment basis as it is requested by the learner or assigned to the learner.
4. Interaction is conducted on a no-appointment basis.

For maximum benefits, tutors should be available when the learner needs them. Therefore, a no-appointment type of arrangement for tutor-learner interaction is preferred. However, this arrangement can lead to overcrowding and frustration on the part of the learner if adequate help is not available during peak use hours.

Suggested Benefits of Peer-Tutoring

Benefits to the Learner

Certain benefits that may be gained from peer-tutoring programs are independent of the specific goals that are set for the program. Gartner (1971), Goldschmid and Goldschmid (1976) and Thelan (1969) suggest that peers are the most important source of influence for a student. Hence, in addition to any direct cognitive gains that may be achieved through personal individualized instruction, there are personal adjustment gains that may be achieved through close personal contact with the tutor. And, these personal adjustment gains may indirectly lead to higher academic achievement by making college a more satisfying experience. Suggested personal adjustment gains include:

1. an increase in cooperation,
2. a decrease in competitive behavior,
3. an increase in motivation,
4. an increase in self-confidence and self-esteem,
5. a decrease in prejudice.

Benefits to the Tutor

In addition to peer-tutoring programs benefiting the learner, it is suggested that the tutors benefit academically from their participation in the program. Gartner (1971) suggests that a tutor, having taught another, may himself learn as a result of a number of processes. He states:

> He reviews the material; he has to organize, prepare, illustrate the material to present it to his students; he may try to reshape or reformulate it so as to enable his pupil to learn it and thus himself sees it in a new way; he may need to seek out the basic character of the subject, its structure, in order to teach it better, and may thereby himself understand it better (p. 62).

In addition, Gartner suggests that tutors may not only learn subject-matter content by tutoring, but they may also learn how to learn. He states:

> Observing another learn and trying to attune his teaching so as to further another's learning gives the teacher insight into the general learning process and better enables the teacher to learn when he again is in the pupil role. In other words, not only may a child learn from the act of teaching, but having been a teacher he may then be a better learner when he again becomes a pupil. And perhaps further, this moving back and forth between teacher and pupil roles, with learning taking place in both, may provide a quantum leap in the amount of learning that occurs (p. 63).

Clark (1976) suggests that in addition to any direct compensation that tutors may receive in the form of money or academic credits, tutors gain the satisfaction of helping others through a course that they might otherwise fail.

Evaluation

Reed (1974) suggests that a systematic program evaluation should be an integral part of every peer-tutoring program and the evaluation criteria and methods should be constructed as the program is being structured. Evaluation results can then be used as an aid for program improvement. Criteria for determining program effectiveness are summarized in Table 9.

TABLE 9

CRITERIA FOR DETERMINING PROGRAM EFFECTIVENESS

1. Improvement in academic achievement.
2. Lower attrition rates.
3. Improvement in standardized measures of socio-psychological factors such as attitude toward learning and self-esteem.
4. Overall positive subjective learner reaction.
5. Overall positive subjective faculty reaction.

Certainly the criteria that are selected is dependent upon the objectives that are set for the program.

Methods for determining program effectiveness include statistical comparisons between students who use the tutoring services and those who don't, and questionnaire surveys.

Evidence of Program Effectiveness

Scientific research on the effectiveness of peer-tutoring programs is very limited. Klaus (1975) suggests that structured experiments do not lend themselves to tutoring programs. It is difficult to standardize programs and it is difficult to control intervening variables. In addition, when promising programs are developed, it is difficult to actively eliminate students in need from the program to use as a control group. Gartner (1971) describes the research that has been attempted as narrowly conceived schemes that cannot be used to indicate global program effectiveness in an academic setting, or as highly subjective with little scientific value.

Overall results of attempted research present a very favorable impression. However, most of this research has been conducted at the elementary and secondary levels. References for several examples of this research can be found in the reference section of this report. Examples of research conducted at the college level include investigations by Agan (1971) and Brady et. al. (1975). Agan found evidence to suggest that tutored college freshmen performed at higher levels than nontutored students. Brady found evidence to suggest that peer-tutoring programs are effective in reducing mathematics attrition.

Although it is essentially subjective, the best evidence available on the effectiveness of peer-tutoring programs is the opinion of students who seek help from peer-tutors and from educators who direct tutoring programs. For example, in a survey of tutees at Corning Community College (Cohn, 1977) virtually all of the respondents offered positive comments about tutors. Comments included "explains well", "helpful", "well-informed", "hard to replace", "interested",

"patient", and "a sweetheart". Peed (1974) found that educators also had extremely positive opinions toward peer-tutoring programs. In a survey of 64 college programs 75% of the faculty respondents and 91% of administration respondents expressed either very enthusiastic or moderately enthusiastic support for the programs at their schools.

The reader might wonder why this overall positive feeling towards peer-tutoring programs exists. Why is it reasonable to believe that peer-tutors will have any more success in helping students learn than professional educators? Klaus (1975) presents the following rationale for the overall positive opinion of peer-tutoring programs (Table 10).

TABLE 10

A RATIONALE FOR THE SUGGESTED EFFECTIVENESS OF PEER-TUTORING PROGRAMS

1. Tutees receive sustained personal attention that is not available in the traditional classroom or from a busy teacher outside the classroom.
2. Questions are immediately answered.
3. Success is immediately rewarded.
4. Supervised practice opportunities are available without having to wait your turn.
5. It is an alternate form of instruction.
6. Tutors can give students a different point of view.
7. Students may feel more comfortable baring their problems to a peer than to a teacher.

CHAPTER 3

THE MATHEMATICS PEER-TUTORING PROGRAM AT THE STATE UNIVERSITY OF NEW YORK AGRICULTURAL AND TECHNICAL COLLEGE AT COBLESKILL

About the College

Cobleskill Ag-Tech College (founded in 1911) is a two-year unit of the State University of New York located in a rural village approximately 40 miles southwest of Albany. It is a resident college with approximately 2,500 students. Although its primary purpose is to prepare technical students in Food Service, Science, Business, Agriculture, and Nursery Education for work upon graduation, about 10% of the students are Liberal Arts students and approximately 40% of the students transfer to four-year colleges upon graduation.

The Mathematics Department has seven full-time faculty and is primarily a service department for the technologies. Each student in the college has a six-hour math or science requirement and many curricula stipulate that their students satisfy this requirement by studying mathematics. In addition, many students select to study mathematics as an elective General Education course. The department serves the needs of approximately 1,000 students each semester.

The offerings in the Math Department range from arithmetic to differential equations and include courses in statistics, finite mathematics and mathematics of finance. Most of the courses are taught

Objective

The primary objective of the program is to offer academic support to improve achievement in specific mathematics courses.

Type of Program

The program is primarily designed to offer remedial tutoring in mathematics to students who voluntarily seek help with specific difficulties that they are encountering with assignments, review work, and test corrections. Tutors are not expected to teach concepts or skills that are new to the learner. They are expected to help the learner answer specific questions that the learner brings to the tutoring session.

It should be emphasized that tutors are expected to actively engage tutees in the learning process. Tutors should attempt to help tutees overcome their difficulties by asking leading questions, by patiently listening and watching, by offering directions to read certain material in a text, and by offering practice exercises. Tutors should offer a minimum of exposition. In addition, tutors should not directly do any homework problems. They should help the tutees solve similar problems thus enabling them to answer their own specific questions. Furthermore, tutors should concentrate on helping with mathematical problems that are within their competencies. Specifically, tutors should refer students with sophisticated mathematical difficulties to their teachers and students with very poor study habits or socio-psychological problems to the school counselors. When sufficient tutoring services are available, tutors may be used as teacher aides to help students in the classroom with seatwork and as shadow tutors to help high-risk students throughout the semester.

Program Supervision

The program will be directed by a member of the Mathematics Department who will also serve as the tutor trainer. The director has accepted this responsibility voluntarily and it [illegible] addition to his regular course load. Other members of the department will share many of the responsibilities associated with the implementation of the program.

Tutor Selection

A campaign [see Form 1] will be conducted at the beginning of the Fall semester in each mathematics class to recruit tutors. Interested students who are enrolled in a higher level math course, who qualify for federal work-study funds, and who have demonstrated high achievement in mathematics will be selected to serve as general tutors. The general tutors will each tutor approximately 10 hours a week and attend a 15-hour training program. These tutors will be paid from federal work-study funds.

Other academically qualified students will be given the opportunity to enroll in a one-credit hour special projects course. These tutors will primarily work as tutoring specialists for a specific course and a specific teacher. They will tutor two hours per week during the semester and attend a training program for 15 hours. The tutoring specialists will be assigned to the lower level math courses.

Successful tutors will be invited to continue their participation in the college's program either as general tutors or specialists throughout their college careers. They will not be expected to attend the full training program each semester. However, they will be expected to participate in the last phase of the training program in which tutors discuss problems that they have encountered while tutoring.

Tutor Compensation

The general tutors will be paid for each hour that they tutor and for each hour of training from federal work-study funds. The specialists will receive one hour of elective math credit. In addition, special recognition will be given to tutors by the department. They will be invited to attend special department meetings and a social gathering will be conducted in their honor.

Program Entry Criteria

The program is primarily designed to accept tutees who voluntarily seek help in overcoming specific difficulties that they encounter [see Form 2]. However, tutees may occasionally seek assistance in solving prescribed problems and/or studying prescribed subject-matter materials at the "suggestion" of their teacher.

Tutor-Learner Ratio

To optimize the effectiveness of a peer-tutoring session tutors should work individually with the learner. If two friends come to the Math Lab together with similar problems, then the tutor can work with them simultaneously. Tutors should not attempt to work with groups of students.

Tutoring Location

Peer-tutoring will take place in the Math Lab located in the library. The Math Lab contains adequate numbers of tables and chairs, reference materials, audio tapes and manuals for algebra instructional modules and programmable calculators that can be programmed to offer the students practice on arithmetic and algebraic skills.

Scheduling Arrangements

Tutors will be scheduled during the late afternoon and evening hours Monday through Thursday and on Sunday evenings. Tutors will accept students on a first come-first serve walk-in basis. Tutors should work with tutees in 20-minute blocks when students are waiting for help.

It should be emphasized that tutors will give their undivided attention to one student at a time. When no tutors are available, students seeking help will simply have to wait or come back at another time.

Training Program

The components of the peer-tutor training program are carefully outlined in the next chapter and in the trainer's manual that appears in Appendix B of this report. The main training sessions will be conducted in six conveniently scheduled two-hour sessions during the first three weeks of the semester. These sessions will be followed by three one-hour discussion sessions that will be periodically scheduled throughout the semester. Major topics included in the main training sessions are given in Table 11.

TABLE 11

TRAINING SESSION TOPICS

1. Characteristics of the mathematics curriculum.
2. Characteristics of the tutees.
3. Program objectives.
4. Tutor responsibilities.
5. Establishing an atmosphere to promote learning.
6. Instructional strategy.
7. Tutoring procedures.
8. Tutoring practice - common mathematical difficulties.
9. Tutoring practice - solving word problems.
10. Advising on study skills.
11. How to use the learning aids that are based in the Math Lab.
12. Discussion of problems encountered while tutoring.
13. Tutor evaluation conference.

Program Evaluation

The effectiveness of the overall peer-tutoring program will be evaluated using two criteria: the popularity of the program as indicated by student use [see Forms 5,6,7] and the opinion of the math faculty, tutors, and tutees as indicated on questionnaires distributed at the end of the Fall semester [see Forms 8, 9, and 10].

The effectiveness of the training program in training capable student tutors will be evaluated using two criteria: trainer observation of the tutors at work [see Form 10] and the opinion of the math faculty, tutors, and tutees as indicated on questionnaires distributed at the end of the Fall semester [see Forms 8, 9, and 10].

Tutor Evaluation

Tutors will be individually observed by the trainer in an actual tutoring session at least once during the session. The observation will occur during the ninth or tenth week of the semester. After the observation a private evaluation will be conducted with each tutor. Tutors who show a serious weakness in skills will be given specific suggestions for improvement and reobserved.

The Implementation of the Peer-Tutoring Program

The preceding description of the design of a peer-tutoring program is a model that the author attempted to implement and direct during the Fall, 1977 semester at Cobleskill Ag-Tech College. The author recognized during the development of the program design that the model was not an ideal, but one that could best be implemented under existing conditions at the college. However, there were unforeseen circumstances that caused the actual tutoring program to vary from its original design.

A recruitment program was conducted during the first week of classes of the semester. Several students applied to work for money and the program director directed those applicants with sound academic credentials to apply for federal work-study funds. Funds were available to hire five

eligible students for a total of 36 hours per week. In addition, eight students applied to tutor two hours per week for one hour of college credit. All eight students were accepted in the program. Applicant interest was the basis for their acceptance.

The tutor training sessions were conducted from 6 P.M. to 8 P.M. on Monday, Tuesday, Wednesday, and Thursday evenings of the second week of classes. Although the program design called for six two-hour training sessions, academic and extracurricular student commitments made it very difficult to schedule time periods that were convenient for all persons involved. The time spent on tutoring practice was condensed and the study skills and learning-aids components of the training program were simply summarized.

The tutors began working in the Math Lab at the beginning of the third week of classes. The availability of tutoring services was advertised by a flyer [see Form 2] and by teacher explanation in each math class. In all there were 13 tutors available for a total of 52 hours each week during the hours of 3 P.M. to 5 P.M. and 6 P.M. to 9 P.M. Monday through Thursday and 7 P.M. through 9 P.M. on Sundays. Tutors were available to help in all courses except Topics from Mathematics, Finite Mathematics, and Calculus II-IV.

Discussion sessions were conducted with the tutors during the sixth and tenth week of classes. Each session lasted about one-half hour. There did not seem to be any major problems and the discussions both times centered around rearranging the tutoring schedules to match the attendance patterns of the tutees. Although the sessions were scheduled at a time that was supposedly convenient for all tutors, eight tutors attended the first meeting and only five tutors attended the second meeting.

A final program evaluation session was conducted during the last week of classes. The meeting lasted about one hour and many interesting and valuable comments were made by the tutors. These comments are summarized in the evaluation section of this report. Again, attendance at the meeting was a problem. Although the meeting was announced as being mandatory, and all tutors were theoretically free to attend the meeting, two tutors were absent. One of the tutors who was absent was a Special Project student. That tutor did not receive course credit.

It should be noted that the program director did not conduct the individual tutor evaluation that is outlined in the program design. The time necessary to conduct such an evaluation was beyond the director's allowable time commitment for the program.

CHAPTER 4

TUTOR TRAINING PROGRAM

Rationale

Educators who have worked on establishing and conducting peer-tutoring programs appear to be in general agreement on the need for a training program for the tutors (see Melaragno, 1976; Reed, 1974; Lieblich, 1977; Gartner, 1971; Deterline, 1970; Harrison, et. al., 1969; Cember and Tarkan, 1973; Klaus, 1975; Clark, 1976; and Niedermeyer, 1970). For example, in an interesting study comparing trained and untrained fifth-grade tutors, Niedermeyer (1970) found the trained tutors to be more effective than the untrained tutors. His conclusions from the study were quite blunt. If you want tutors to behave according to established psychological principles, then they should be trained. Reed (1974) reached similar conclusions after surveying tutoring programs in higher education. He suggests that training programs are an essential ingredient of effective peer-tutoring programs.

The emphasis that has been placed upon the inclusion of a training program as an integral part of a peer-tutoring program is based on the hypothesis that the teaching that the peer-tutors have been receiving in the classroom should not be used as a model to guide them

in their tutoring activities. This hypothesis is based upon the following observations:

1. The teacher-to-student relationship is different than the peer-tutor-to-tutee relationship. The teacher is a professional educator who is in a position of authority. The peer-tutor is simply another student who is being asked to help a peer.

2. The teacher designs his teaching techniques to be effective with large groups of students. These techniques usually include an emphasis on the teacher giving information or showing how to perform a certain mathematical operation. The student does not have a great deal of opportunity to verify his knowledge or skills in the classroom. On the other hand, the tutor helps students individually. Hence, the learner has the opportunity to practice his skills and receive immediate feedback. In addition, there does not have to be a tight time restriction on the tutor-tutee contact as there is in a classroom.

3. The teacher is usually involved with teaching new or unfamiliar subject-matter. The tutor is involved with helping the learner with problems on material that he is somewhat familiar.

Objective of the Training Program

Recall that the general objective of the peer-tutoring program at Cobleskill is to offer academic support to improve achievement in specific mathematics courses. Specifically, the tutoring program is designed to offer remedial tutoring to students who voluntarily seek help due to specific mathematical difficulties that they encounter with assignments, review work, and test corrections.

It should be emphasized that the objective of the training program is not to train the tutors to be mathematics teachers (in the traditional sense) nor is the training program designed to produce mathematics specialists. The objective of the training program is to train tutors so that they may help tutees in an efficient and satisfying manner to clearly identify and solve their own particular problems. Hopefully, the training program will also help the tutors to establish a tutor-tutee relationship that will encourage the tutee to seek out and learn for himself by modeling his learning activities after those that are used by his tutor.

The Instructional Strategy

Instructional strategies can be classified along the expository-discovery continuum.

Expository
Emphasize Content
Advocate: D. Ausubel

Discovery
Emphasize Process
Advocate: J. Bruner

In expository teaching, as described by Ausubel (1968) the entire content of what is to be learned is presented to the learner in its final form. The task of the learner is to internalize the content into his cognitive structure so that it is available for the learner's use at some future date. When an expository approach (or lecture) is used in the classroom the teacher must carefully sequence the exposition so that the new content to be learned can be meaningfully related by the learner to previously learned content that has already been internalized.

On the other end of the strategy continuum is discovery teaching. In discovery learning, the emphasis is placed upon the kinds of processes learned by the student, in contrast to the specific subject-matter content that he may acquire. In discovery learning, what is to be learned is not simply given to the learner. The learner is expected to become deeply involved in a problem-solving process. He must rearrange information, use trial and error experiments or attempt to note generalizations and patterns. At the end of this process of intellectual activity, the learner is expected to "discover" a new relationship and thus solve the problem. Jerome Bruner (1968) is an advocate for discovery learning. He concludes:

> A body of knowledge, enshrined in a university faculty and embodied in a series of authoritative volumes, is the result of much prior intellectual activity. To instruct someone in these disciplines is not a matter of getting him to commit results to mind. Rather, it is to teach him to participate in the process that makes possible the establishment of knowledge. We teach a subject not to produce little living libraries on that subject, but rather to get a student to think mathematically for himself, to consider matters as a historian does, to take part in the process of knowledge-getting. Knowing is a process not a product (p. 72).

Hernandez (1973) notes that no one strategy has been shown to be effective under all conditions. She suggests:

> The most promising direction toward effective mathematics teaching at this time appears to be the use of a variety of strategies tailored to the objectives of the lesson and student needs at the time of instruction (p. 607).

It has been this reporter's personal experience that most mathematics teachers at the college level concur with Hernandez's suggestion. At appropriate times in a course, teachers guide students to the discovery of principles and patterns and through the solution of new types of problems. However, as Johnson and Rising (1967) indicate discovery is patience-trying and time-consuming. Large-classes, strict time-frames, and "large" bodies of content and skills that must be included in various courses cause classroom teachers to mainly use instructional strategies near the expository end of the continuum. For instructional efficiency, they lecture on content and "show" students how to solve problems.

On the other hand, tutors do not face the instructional restrictions that are faced by the classroom teacher. They help students individually for extended periods of time. In addition, they are not responsible for teaching the student specific subject-matter content (that is the teachers job). They are responsible for helping the student learn how to solve specific problems.

The conditions that the tutors face suggest that their instructional strategy should be concentrated toward the discovery end of the continuum. And, this is the strategy that the peer-tutors are trained to use.

As a general principle, the tutor should never help by personally giving the learner information, except, in response to a direct question, when indicating a correct response or when giving praise. The tutor should direct the learner to information that is contained in his textbook, help the learner to establish principles and patterns by asking him leading questions, and most importantly, be a patient listener and watcher as the learner becomes deeply involved in attempting to answer his own questions.

The instructional strategy that is used to train the tutors follows the same principles that the tutors are expected to use:

1. Exposition is kept at a minimum.
2. Brainstorming and role-playing are used as the main instructional techniques.
3. Tutor-trainees are asked to suggest proper tutoring procedures and the merits of their suggestions are discussed.
4. Tutors have the opportunity to practice tutoring techniques by role-playing.

In sum, the tutees are not to be shown "how to" solve problems and the tutors are not shown "how to" tutor. They learn how to accomplish their respective goals by becoming "actively involved" in the learning process.

Components of the Training Program

There appears to be general agreement on the essential components of an effective training program (see the references given in the Rationale section of this chapter). Each component is designed to be an integral part of a total training program whose goal is to train the peer-tutors to accomplish the objectives set for the tutoring program.

Characteristics of the Mathematics Curriculum

This component is designed to familiarize the tutor with the prerequisites, content, and objectives of each mathematics course at Cobleskill so that the tutors can properly guide the tutees in the learning process. It should be noted that the college's offerings may have different points of emphasis than corresponding high school courses.

Characteristics of the Tutee

Many of the tutors, due to their academic ability, will be the type of student who might not normally be tutees themselves. Therefore, it may be difficult for the tutors to appreciate the tutees needs and concerns. This component is designed to acquaint the tutors with the reasons that students seek tutoring and potential tutee socio-psychological and academic characteristics. It should be emphasized that the training should not give a poor impression of tutees. Such preconceived notions can lead to an unsuccessful tutor-tutee relationship. The training is designed to help the tutor understand and appreciate the tutee's special needs and concerns so that he will improve his chances of helping the tutee.

Program Objectives

This component is designed to inform the tutor of the specific objectives that have been set by the Mathematics Department for the tutoring program. The tutor must be fully aware of the very limited objectives that have been set for the program for two basic reasons:

first, so that he can understand how the training program relates to the type of tutoring that he is to perform and second, so that he can tutor in a way to accomplish the objectives.

Tutor Responsibilities

This component of the training program is designed to inform the tutor of specific responsibilities that are associated with being a tutor in an efficiently operated program. It is important to emphasize that responsibilities are requirements, because he may not see them as being important. For example, the tutor may not appreciate the need to keep accurate records. However, the records are needed for program evaluation purposes. A rationale for each duty and responsibility is included in the component.

Establishing an Atmosphere to Promote Learning

Wittmer and Myrick (1974) suggest that all humans have a basic need to strive for self-enhancement. However, they state:

> When an individual encounters forces which cause him to become closed to his experiences, or doubt himself and those around him, he cannot reach an optimal level of learning and functioning (p. 3).

Therefore, Wittmer and Myrick conclude that:

> ...the goal of education should be to facilitate an openness in attitude so that individuals feel free to engage in personal growth experiences (p. 3).

Based on this conclusion, it is of primary importance that the tutor establish an atmosphere in the Math Lab which will encourage the tutees to take advantage of the tutoring program and in general make learning

in the Math Lab an enjoyable experience. This component of the training program is designed to acquaint the tutor with methods for establishing an atmosphere that promotes learning. These methods take advantage of the naturalness of the relationship that exists between peers at the same college.

Instructional Strategy

Schmalz (1973) suggests that:

> ...teachers must do more than just teach students a certain body of facts. They are responsible for teaching students processes of thinking and learning so that they have the ability to discover something new through consideration and reorganization of the known (p. 619).

It is debatable as to whether or not teachers can actually teach students the process of thinking and learning. However, it is reasonable to believe that properly phrased questions can stimulate the learner to attempt to think about ways to deal with ideas and problems. Therefore, the main instructional strategy that the tutor should use is asking questions that will stimulate thinking. This component of the training program is designed to acquaint the tutor with the types of questions that should be used in the tutoring process and to give him guidelines for proper questioning procedures.

Several educators have developed methods for categorizing questions (see Godbold, 1973; Lucking, 1975; Lowry, 1974; Hunkins, 1972; Perl, 1974; Miller, 1973; Ryan, 1973; and Schmalz, 1973). Most of the systems are based upon the classification of educational objectives developed by Bloom, et. al. (1956). The classification system that is being taught in

the training program is the one developed by Schmalz. Its basic simplicity will enable the tutors to quickly learn, understand, and use the scheme.

Tutoring Procedures

This component of the training program is designed to familiarize the tutor with specific procedures that the tutor should follow in the tutoring process. The procedures start with a tutor-tutee introduction and follow through the diagnosis of the problem and the actual instruction to the end of the tutoring session. The component is not designed to stifle tutor creativity. It is designed to offer a path for the tutor to follow. Special emphasis is placed upon the type of problems that the tutor should handle and those that he should refer to other sources for help.

Tutoring Practice - Common Mathematical Difficulties

Not only do tutors have to be able to follow established tutoring procedures, but they also have to understand the mathematical content being studied in the tutoring session. This component of the training program is designed to give the tutor a deeper understanding of some of the commonly misunderstood ideas from elementary and intermediate algebra (such as dividing by zero) by helping students (in a role-playing situation) overcome problems caused by their not understanding these concepts. The tutoring practice and subsequent feedback, and the deeper understanding of the mathematical content will enable the tutors to gain facility with both tutoring procedures and explaining mathematical content.

Tutoring Practice - Solving Word Problems

Of all the topics studied in elementary and intermediate algebra, the one that causes students the most difficulty is the solution of word problems. Tutors will certainly be faced with the task of helping students to solve the various types of word problems that they encounter.

This component of the training program is designed to acquaint tutors with suggested procedures that students should follow to solve a word problem. Then, tutors are given the opportunity to practice helping students (in a role-playing situation) to follow these procedures to solve word problems.

Advising on Study Skills

Although the primary objective of the tutoring program is to help students with mathematical difficulties, they may also be asked by tutees how to study mathematics so that they may prevent reoccurring difficulties. This component of the tutoring program is designed to familiarize the tutors with a basic list of acceptable studying procedures that will improve the tutees chances of succeeding in his mathematics courses.

How to Use the Learning Aids that are Based in the Math Lab

The Math Lab contains reference textbooks, audio tapes, tape recorders and instructional modules, and programmable calculators that can be programmed to offer students the opportunity to practice arithmetic and algebraic skills. Tutors should be able to use the reference

texts for additional sources of practice problems. In addition, the tutors should be familiar with the use of the audio tapes and the calculator so that they can show students how to use them. It should be emphasized that it is not the responsibility of the tutors to suggest that tutees use the audio tapes or the calculator. The tutors' job is to help administer a prescription that is given by a faculty member. This component of the training program is designed to familiarize the tutors with the lab-based learning aids.

Discussion of Problems Encountered While Tutoring

This component of the training program is designed to offer tutors the opportunity to discuss problems that they encountered while tutoring in the Math Lab. Suggestions made by the tutors and by the trainer should enable each tutor to overcome difficulties that he has encountered.

Tutor Evaluation Conference

Each tutor will be observed by the trainer while conducting an actual tutoring session in the Math Lab. The subsequent tutor evaluation conference will offer the tutor feedback in a nonthreatening manner so that he may improve his skills.

Implementation of the Training Program

Training experiences that may be used to implement the components of the training program are included in a trainer's manual found in Appendix B of this report. The manual includes easy-to-follow instructions to the trainer for implementing the program.

CHAPTER 5

THE EVALUATION OF THE TUTORING PROGRAM

The evaluation of an educational program is an essential component of the program. It offers the educator the opportunity to gather input from all individuals who were involved with the implementation of the program, to analyze the input to identify successful and unsuccessful aspects of the program, and to recommend modifications that will lead to an improved program during future implementations.

To evaluate the effects of the tutor training program within the general context of the overall tutoring program conducted at Cobleskill during the Fall, 1977 semester, data was gathered from Math Lab records, students, math faculty, and tutors. The analysis of the data and a set of recommendations follows.

Analysis of Math Lab Records

Tables 12 and 13 present a summary of the data obtained from the Tutor Logs (Form 5 in Appendix A).

TABLE 12

OVERALL MATH LAB USE

	Sept.	Oct.	Nov.	Dec.	Total
Number of Tutoring Days	15	22	20	12	69
Number of Tutoring Hours	120	185	144	75	524
Tutee Attendance	67	116	107	33	323
Average Attendance Per Hour	0.56	0.63	0.74	0.44	0.62

TABLE 13

LATE AFTERNOON AND EVENING MATH LAB USE

	Late Afternoon (3 P.M.-5 P.M.)	Evening (6 P.M.-9 P.M.)	Total
Number of Tutoring Hours	102	422	524
Tutee Attendance	59	264	323
Average Attendance Per Hour	0.58	0.63	0.62

Discussion

It is interesting to note that the average attendance in the Math Lab increased from September through November (Table 12). This increase, in itself, may be an indication of the success that the Math Lab enjoyed. On the other hand, the decrease in average attendance in December may indicate that near the end of the semester students are concentrating on preparing for final exams rather than seeking help with assignments, or it might be a sign that students became dissatisfied with the help that they received in the Lab.

The overall attendance in the Math Lab of 0.62 students per hour appears to be rather low. One might expect at least one student per hour to "wander" in for help. However, attendance per hour for individual tutors ranged from lows of 0.20 (20 students in 98 hours) and 0.25 (5 students in 20 hours) to highs of 1.22 (28 students in 23 hours) and 4.05 (85 students in 21 hours). Hence, it appears that students did "flock" to tutors who they thought would help, while avoiding other tutors.

Table 13 indicates a fairly even split in attendance during the late afternoon and evening hours. On nonresident campuses this attendance pattern might differ greatly.

The Tutee Log and the Individual Tutee Record (Forms 6 and 7, respectively) were designed to gather information on individual student attendance and attendance by course. These forms were not accurately completed by the tutors throughout the semester, and hence, could not be used for evaluation purposes.

Student Evaluation

The following is a summary of the responses given by 633 math students on a student evaluation survey (Form 10 in Appendix A). The survey was administered during class time in the last week of classes of the Fall, 1977 semester. A computer was used for item and cross item scoring.

TABLE 14

STUDENT USE OF MATH LAB BY COURSE

Course		Number of Respondents	Number of Lab Users	%
El. Algebra	(MA-101)	178	42	24
Math of Finance	(MA-103)	68	29	43
Int. Algebra	(MA-111)	128	41	32
Trigonometry	(MA-112)	33	12	36
Statistics	(MA-125)	23	5	22
Pre-Calculus	(MA-131)	123	32	26
Calculus I	(MA-231)	80	12	15
TOTAL		633	173	27

TABLE 15

FREQUENCY OF ATTENDANCE PER STUDENT USER

Frequency	Course							
	MA-101	MA-103	MA-111	MA-112	MA-125	MA-131	MA-231	TOTAL
1-3	30	15	25	7	3	18	9	107
4-6	9	6	11	5	2	8	2	43
7-12	3	5	3	0	0	4	0	15
13-18	0	1	1	0	0	2	1	5
19-	0	2	1	0	0	0	0	3
TOTAL	42	29	41	12	5	32	12	173

TABLE 16

STUDENT USE AS RELATED TO GRADE EXPECTATION

Course	PERCENT OF USERS* IN EACH EXPECTED GRADE					
	A	B	C	D	F	Total
MA-101	$\frac{5}{44}$ = 11%	$\frac{13}{66}$ = 20%	$\frac{15}{44}$ = 34%	$\frac{9}{13}$ = 69%	$\frac{0}{1}$ = 0%	$\frac{42}{178}$ = 24%
MA-103	$\frac{6}{16}$ = 38%	$\frac{7}{25}$ = 28%	$\frac{6}{14}$ = 43%	$\frac{6}{8}$ = 75%	$\frac{4}{5}$ = 80%	$\frac{29}{68}$ = 43%
MA-111	$\frac{0}{11}$ = 0%	$\frac{13}{52}$ = 25%	$\frac{21}{51}$ = 41%	$\frac{7}{12}$ = 58%	$\frac{0}{2}$ = 0%	$\frac{41}{128}$ = 32%
MA-112	$\frac{0}{2}$ = 0%	$\frac{4}{12}$ = 33%	$\frac{8}{17}$ = 47%	$\frac{0}{1}$ = 0%	$\frac{0}{1}$ = 0%	$\frac{12}{33}$ = 36%
MA-125	$\frac{0}{4}$ = 0%	$\frac{1}{6}$ = 17%	$\frac{4}{9}$ = 44%	$\frac{0}{4}$ = 0%	$\frac{0}{0}$ = -	$\frac{5}{23}$ = 22%
MA-131	$\frac{3}{19}$ = 16%	$\frac{12}{62}$ = 19%	$\frac{13}{33}$ = 39%	$\frac{3}{8}$ = 38%	$\frac{1}{1}$ = 100%	$\frac{32}{123}$ = 26%
MA-231	$\frac{2}{15}$ = 13%	$\frac{2}{28}$ = 7%	$\frac{5}{23}$ = 22%	$\frac{3}{12}$ = 25%	$\frac{0}{2}$ = 0%	$\frac{12}{80}$ = 15%
TOTAL	$\frac{16}{111}$ = 14%	$\frac{52}{251}$ = 21%	$\frac{72}{201}$ = 36%	$\frac{28}{58}$ = 48%	$\frac{5}{12}$ = 42%	$\frac{173}{633}$ = 27%

*A user is a student who attended the Math Lab at least once.

TABLE 17

TIME DISTRIBUTION OF LAB USE

Used the Lab		n
A.	At various times during the semester.	71
B.	Mainly during the first half of the semester.	25
C.	Mainly during the second half of the semester.	26
D.	Mainly during the last few weeks of the semester.	13
E.	Mainly during the first few weeks of the semester.	6
F.	Mainly during the middle weeks of the semester.	28
	TOTAL	169

TABLE 18

IMPETUS TO ATTEND THE MATH LAB

	n	%
1. Teacher suggestion.	10	6
2. Peer recommendation.	15	9
3. Self-motivation.	148	86
TOTAL	173	

TABLE 19

REASONS FOR NOT ATTENDING THE MATH LAB

	n	%
1. Help was not needed.	162	35
2. Enough help was available elsewhere.	172	37
3. The student heard that the Math Lab was not a good source of help.	8	2
4. The hours were not convenient.	52	11
5. Other.	66	14
TOTAL	460	

TABLE 20

MAIN TYPE OF HELP SOUGHT IN THE MATH LAB

	n	%
1. Help on assignment problems.	113	70
2. Review for test.	43	27
3. Test corrections.	6	4
TOTAL	162	

TABLE 21

TUTOR DESCRIPTION

	n	%
1. Helpful and friendly.	109	64
2. Helpful, but not very friendly.	12	7
3. Not very helpful, but nice.	44	26
4. Rather unhelpful and rude.	5	3
TOTAL	170	

TABLE 22

MATH LAB CONDITIONS

		n	%
1.	The lab was an efficient and pleasant place to seek help.	92	61
2.	The lab was usually overcrowded.	28	19
3.	The lab had enough tutors, but it was not an efficient and pleasant place to seek help.	31	21
	TOTAL	151	

TABLE 23

TUTOR RESPONSIBILITY

		n	%
1.	The tutors were punctual in following their assigned work scheduled.	120	76
2.	Were frequently late or absent.	37	24
	TOTAL	157	

Pertinent Student Comments

1. When I went to the Math Lab the tutors were not there at the scheduled time. (Similar comments were made by several other students.)
2. Tutors were somewhat helpful, although sometimes I felt them inadequate for the job. They should be screened more effectively.
3. Teachers have different teaching styles. It is important to have a tutor who has the same teacher as you have.
4. I never knew about the Math Lab.
5. I would have gone more often but the schedule was not good for me.
6. The Lab really helped. Tell more people about it.
7. The Lab should have an appointment sign-up.
8. Sometimes the Lab is too crowded.
9. The tutor got me all mixed up.

Discussion

The results of the student evaluation survey may only be used to approximate the actual Math Lab use and student opinions. Students who might have used the Math Lab and subsequently withdrew from classes or were absent from class on the day of the survey administration are not included in the survey population.

Tables 14 to 16 indicate that the Lab was used by 27% of the respondents with the vast majority of the students (62%) attending from 1-3 times. In addition, it appears that the students with relatively low grade expectations used the Lab the most.

The course that attracted the most attention in the Math Lab was Math of Finance. This may be due to one unusually talented tutor, as well as to the nature of the factually-oriented subject matter. The

course that attracted the least attention in the Lab was Calculus I. Although the calculus tutors appeared to be of high quality, the complicated nature of the material may not lend itself to peer-tutoring.

Although several reasons are suggested for students not attending the Math Lab, it is interesting to note that only 2% of the respondents heard that the Lab was not a good source of help. This fact coupled with the generally positive responses given in Tables 21-23 suggest that the Math Lab enjoyed a good reputation.

It is also interesting to note that 19% of the respondents found the Lab usually overcrowded. This response appears to be in conflict with the Lab's apparent low rate of use. The observed overcrowding could be caused by student attendance during popular testing periods.

The responses in Table 23 indicate that 24% of the respondents found that tutors were frequently late or absent. This is certainly one area that must be improved upon, if the Lab is to be an efficient operation. Closer director supervision would probably lead to more strictly maintained tutor schedules.

In addition to the several complaints about tutors not following the posted schedule (a situation which was very annoying to all concerned), there were several constructive comments made by the students on the evaluation form. Improved screening of tutors, appointment sign-ups, and the involvement of more tutors so that students can be helped by classmates are all subjects for future consideration.

Faculty Evaluation

Table 24 presents a summary of the responses given by seven faculty members on the faculty evaluation survey (Form 8 in Appendix A). The survey was administered the week following the close of the Fall, 1977 semester.

TABLE 24

FACULTY EVALUATION OF THE MATH TUTORING PROGRAM

1. Overall, the tutoring program:
   - 2 a. appeared to be used by very few (less than 20%) of my students
   - 2 b. appeared to be used by some (from 20% to 50%) of my students
   - ___ c. appeared to be used by many (more than 50% of my students
   - 3 d. I really couldn't tell if it was used or not by my students

2. Overall, it appeared that the students who went to the Lab:
   - 1 a. enjoyed the program
   - 1 b. really didn't enjoy the program
   - 5 c. didn't indicate their feelings to me

3. Attendance at the Math Lab:
   - 3 a. generally helped students
   - 1 b. really didn't help
   - 1 c. I really don't know if it helped or not
   - 2 d. helped students pass the course who might not have passed
   - ___ e. kept attrition rates down
   - 1 f. improved student attitudes
   - ___ g. motivated students to achieve

4. I felt that the tutors:
   - 1 a. were knowledgeable
   - ___ b. used proper techniques
   - 4 c. were responsible

5. The tutor training program:
   - 4 a. appeared to help the tutors
   - ___ b. was really not needed
   - 3 c. I do not know if it was needed or not

6. In general, the tutoring program:
   - 4 a. is a worthwhile endeavor
   - ___ b. is not worthwhile
   - 3 c. I do not know if it is worthwhile or not

Pertinent Faculty Comments

1. Overall, the tutors appeared to be very responsible. However, I had negative feedback on one tutor.

2. Special tutors did not keep in contact with the faculty.

3. The Math Lab is best for students in the lower level algebra courses. Trigonometry students had difficulty getting help in the Lab.

4. Tutors had trouble with word problems.

5. More supervision would help. When peer tutors cannot help a student, a professional tutor could take over.

6. It is difficult to know whether or not the training program helped. There is little contact between tutors and faculty.

7. I heard that near the end of the semester that some tutors were not showing up.

8. Greater tutor coverage really helped this semester. With this many tutors organization and training is essential.

9. Tutoring seems like a good idea. However, I do not have enough facts to warrant an opinion.

Discussion

The results of the faculty evaluation survey fail to offer a strong endorsement for the tutoring program. Three of the seven faculty could not tell if the tutoring program was used by their students nor could they offer any knowledgeable opinions on the overall operation of the program. Of these three faculty members, one taught three sections of calculus, a course that did not receive very much attention in the Math Lab, and the other two were new faculty members. Perhaps the new faculty members did not motivate their students to use the Math Lab as much as the "old-timers." The four faculty who offered opinions on the tutoring program generally gave positive replies. They thought that the program helped their students.

And, after comparing this group of tutors with the ones from previous semesters, they thought that the training program was beneficial.

The comments made by the faculty offer some additional insights. It was felt that the tutors were responsible but there was some room for improvement. In addition, it was felt that tutors helped best with the lower level courses although they did have difficulty with algebra word problems.

There were two other comments that were especially interesting. One person remarked that the special tutors did not keep in contact with the faculty, while another remarked about the lack of contact between faculty and tutors. It is true that there was little personal contact between faculty and tutors. Perhaps the director can be faulted for not carrying through on his plans to invite tutors to department meetings. On the other hand, it is also true that faculty did not make any efforts to make personal contacts with the tutors. And it appears that the responsibility for faculty-tutor interaction should be on the faculty.

Tutor Evaluation

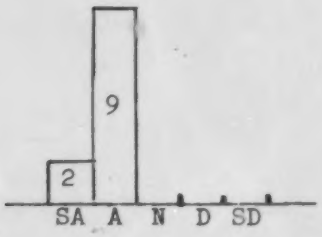
Table 25 presents a summary of the responses given by eleven tutors on the tutor evaluation survey (Form 9 in Appendix A). The survey was administered at a tutor meeting held during the last week of classes of the Fall, 1977 semester.

TABLE 25

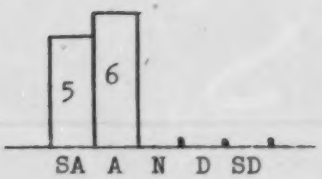
TUTOR EVALUATION OF THE MATH TUTORING PROGRAM

Let SA = Strongly Agree
A = Agree
N = Neutral
D = Disagree
SD = Strongly Disagree
(n = 11)

1. I felt that I helped most students who came to the Math Lab.

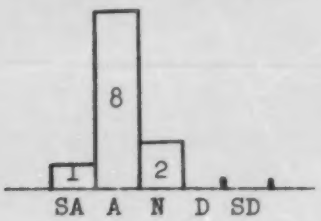


2. I got along well with the students who I tutored.



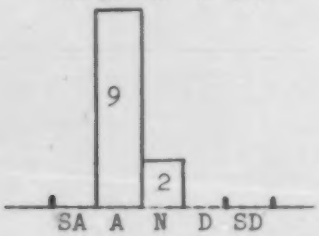
3. I feel that the tutoring program has helped me academically.

4. I enjoyed tutoring.



5. I feel that the training program helped me to be a better tutor.

6. I felt prepared for tutoring.



7. The training program was enjoyable.

Pertinent Tutor Comments

1. I received many favorable comments on the tutoring program. I helped others while enjoying myself.
2. Some tutors don't come when they are supposed to. This isn't fair.
3. Alot of students don't know about the tutoring program.
4. Have fixed hours day and night for the Lab to be open. This should avoid confusion with regard to tutor schedules.
5. Teachers should emphasize that students should come in with specific problems.
6. Students should be informed that tutors are not infallible. Perhaps a big poster stating "Tutors Make Mistakes" would help.
7. It is best to tutor a course that you are presently taking.
8. There were no problems with students fooling around.
9. The training program was alright, but it was a little long.
10. The training program was "too much" during the first full week of class. Should be broken up into three or four weeks. Perhaps a five week mod course.

11. More time should be spent going over word problems. (Similar comments made by several students.)

12. There was too much time spent on nonessentials instead of helping us learn to teach.

13. Faculty should hold special reviews for tutors.

Discussion

The responses given to items 1 and 2 on the survey indicate that the tutors have a strong self-image with regard to their tutoring capabilities. In addition, responses to items 3 and 4 indicate that a majority of the tutors found tutoring to be academically beneficial as well as enjoyable. Although the responses to item 6 indicate that the tutors felt prepared to tutor, the responses to items 5 and 7 do not indicate strong positive feelings towards the training program.

It should be noted that even after repeated requests two of the thirteen tutors did not complete the survey. It appears that the one tutor who worked for money and one tutor who worked for college credit lost interest in tutoring at the end of the semester. Perhaps they would have given some negative responses on the evaluation survey.

There were several very constructive suggestions made by the tutors on the evaluation form. A less intense training program held during the first three or four weeks of classes may prove to be more agreeable to the students. In addition, a greater concentration on the solution of word problems and tutoring practice and less concentration on the introductory aspects of the training program may prove to be more beneficial.

Evaluation Summary

When comparisons are made between the Fall, 1977 tutoring program and the programs conducted during previous semesters, it is apparent that improvements were made. There were more tutors available during more hours and they helped more students. In addition, although no evaluative surveys were administered during previous semesters, the Math Department received fewer complaints about overcrowding, tardiness, absence, and tutor inability to help.

The overall tone of the evaluations made by students, faculty, and tutors is one of guarded enthusiasm. However, the evaluations point out many needed improvements. It takes a great deal of inner motivation for a student to go out of his way and voluntarily seek help in the Math Lab. And, if students are not helped in the Math Lab because of tutor unavailability, tutor irresponsibility or tutor inability, they may never attempt to seek help in the Lab again. In addition, if needing students do not even make initial attempts to seek help in the Lab because of a lack of motivation, the unawareness of the Lab's existance or because of some poor comments made about the Lab, then tutors become bored with inactivity and the Lab loses part of its reason for being.

In sum, it appears that the overall tutoring program was moderately successful in accomplishing its objectives, and, in particular, it appears that the tutor training program is an essential component of the overall tutoring program.

Recommendations

An analysis of the evaluations made by students, faculty, and tutors suggest the following areas for program improvements.

Supervision

It is apparent that a tutoring program can be conducted with limited supervision. However, educators who have attempted to implement tutoring programs recognize the need for a skilled program director to supervise the tutors and the general tutoring program. The program at Cobleskill is no exception. The single ingredient that would do the most to improve the tutoring program is a program director who was free to supervise the Math Lab operation. A director in attendance during Lab hours could:

1. encourage greater tutor responsibility in attendance and record keeping,
2. help students with problems that tutors cannot handle,
3. evaluate the tutors and initiate a program of tutor improvement,
4. schedule training sessions and meetings at times that are convenient for tutors.

If a full-time program director is not a viable suggestion, a faculty member who is given a reduced classload and who finds it convenient to work during the early evening hours is an acceptable alternative. Certainly, the more hours that a director has free for first-hand supervision, the better the program will be.

Faculty Cooperation

If faculty members make special efforts to become actively involved in the overall operation of the tutoring program, their unanimous endorsement of the program might be forthcoming.

Faculty members should:

1. recruit responsible and knowledgeable tutors from each of their courses,
2. periodically throughout the semester remind their students of the existance of the tutoring program,
3. make special efforts to help tutors for their courses by offering them suggestions and special review materials,
4. initiate contacts between themselves and the tutors either at specially called meetings or by "dropping in" at the Math Lab. In this way faculty will appreciate the tutors problems and better understand the overall tutoring operation.

Math Lab Schedule

Students need a commitment on the part of the Math Lab staff that they will be there when they are needed. A schedule that starts and ends at different times each day can cause confusion. Therefore, a fixed schedule of 3 P.M. - 5 P.M. and 6 P.M. - 9 P.M. on Monday through Thursday and 6 P.M. - 9 P.M. on Sundays that includes tutors in each course is appropriate. Within this fixed time frame the program director should have the flexibility of scheduling and rescheduling tutors to meet the needs of students during peak use periods.

Special appointment sign-ups appears to be a scheduling method that should be avoided, if possible. Tutors should be available on a walk-in basis when they are needed.

Tutor Recruitment

The recruitment of special project tutors appeared to be an especially successful aspect of the Fall, 1977 semester. It was felt the interest shown by eight students was encouraging for an initial effort. Perhaps more tutors, as well as more capable tutors, will be interested in participating as special projects students once the program becomes established. For the initial trial simple student interest was used as a criteria for acceptance into the program. This resulted in at least one tutor who did not have the math ability to help students. In the future it is recommended that the program director carefully analyze the math backgrounds of prospective tutors and exclude students with borderline ability from the program.

Several students applied to work as tutors for money under the Federal Work-Study Program. Some students who appeared to be particularly good candidates could not be hired because they did meet the financial restrictions established by the federal program. Although the students who were hired were acceptable candidates, perhaps more mathematically capable students could be hired if monies were not tied to federal restrictions.

It is interesting to note that there were no apparent differences in enthusiasm, tutoring capabilities, and responsibilities between students who were working for credit and those who worked for money. Either method appears to be a viable form of compensation.

Special efforts should be given to recruiting special project tutors for each course that each faculty member teaches. Since most faculty members teach multiple sections of the same course approximately

fifteen tutors would be needed to cover a faculty of seven teachers. Students have suggested that they feel more comfortable receiving help from a tutor who is studying with the same teacher that they have. Similarly, it appears that tutors may be most familiar with courses that they are presently studying. Perhaps the recruitment of highly capable students from the upper level courses will encourage more of the students in those courses to use the Math Lab. On the other hand, the tutors who are hired for money should be high ability students who are capable of helping in most courses in the curriculum.

Tutor Training Program

Perhaps the greatest fault with the tutor training program was that it did not prepare the tutors adequately to help in areas where requests for help are the greatest; the solution of word problems in elementary and intermediate algebra. Since the time available to train tutors is limited modifications should be made in the scheduling and content of the training program to allow for adequate time to review with tutors the solution of various types of word problems.

The tutors suggest that they did not have any problems relating to the tutees and that students did not come in to fool around. Hence, some time can be saved with the introductory lessons. In addition, faculty did not take advantage of the Lab-based learning aids. This aspect of the training program should similarly be deemphasized.

A review of the content of the training program [see Table 11] suggests:

1. The introductory lessons (Lessons 1-4) should be condensed into one two-hour time period. However, program objectives and tutor responsibilities must be emphasized.

2. Instructional Strategies and Study Skills can occupy a second time block.

3. Tutoring Procedures and Tutoring Practice on Common Mathematical Difficulties can occupy a third time block.

4. A Review of Word Problems and Tutoring Practice on the Solution of Word Problems can occupy a fourth and fifth time block, respectively.

5. Two group discussion meetings, an individual tutor obervation and evaluation session, and a group evaluation session at the end of the semester can complete the tutor's training obligation.

The tutors also commented that it was difficult for them to make the necessary time commitment to the training program during the second week of classes. Since attendance at the Math Lab is relatively light during the first few weeks of classes, it might be more convenient, and even advantageous, to spread the tutor training program over a five week period. If the trainees begin their tutoring after the initial introductory session, their experiences in the Math Lab can make the remaining training sessions more meaningful.

The suggestion to schedule the training sessions in the master schedule may eliminate some tutors who must schedule regular academic courses during the time period. If the training program is spread out, mutually agreeable times should be able to be found.

APPENDIX A

FORMS

Contents:

1. Tutor Recruitment
2. Math Lab Announcement
3. Tutor Application
4. Tutoring Contract
5. Tutor Log
6. Tutee Log
7. Tutee Record
8. Math Faculty Evaluation of the Tutoring Program
9. Tutor Evaluation of the Tutoring Program
10. Student Evaluation of the Tutoring Program
11. Tutor Observation

FORM 1: TUTOR RECRUITMENT

TO: MATHEMATICS STUDENTS

FROM: Mathematics Department

RE: Tutoring in the Math Lab

Introduction:

You are invited to share your mathematical abilities with your fellow students by tutoring in the Math Lab.

Tutoring is a rewarding experience. It is satisfying to help others who are experiencing difficulty, you can improve your own mathematical skills, and you can earn money or college credit.

Types of Tutors:

Students who are enrolled in high level math courses, who have high math ability, and who are eligible for work-study funds can apply to work up to ten hours per week. They will be paid for their work and training time.

Students who have a good algebra background and who want to earn college credit can enroll in MA-290 (Special Projects) and receive one hour of college credit per semester. These tutors will tutor two hours per week.

Training Program:

[illegible] will be expected to attend a tutor training program.

Interest

If you are interested in becoming a tutor, contact R. Cameron or D. Cohen in Ryder Hall on or before Friday, September 3, 1977.

FORM 2: MATH LAB ANNOUNCEMENT

TO: MATHEMATICS STUDENTS

FROM: Mathematics Department

RE: Math Lab

The Math Lab is now in operation to help students overcome mathematical difficulties. The Math Lab is located in the basement of the library.

Students who need help with their assignment difficulties, with reviewing for tests, or with test corrections should bring specific problems to the Math Lab. If you have a general misunderstanding of subject-matter, it is best to consult your teacher.

If there is a special tutor assigned to your class, attempt to see that tutor for help. If that is inconvenient, consult the general tutors.

Special Tutors

	Name	Course	Schedule
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

General Tutors

	Name	Can Help In	Schedule
1.			
2.			
3.			
4.			

FORM 3: TUTOR APPLICATION

Name _____

Address (College) _____

(Home) _____

_____

Phone (College) _____

Major Department _____

Plans After Graduation _____

_____

Math Course Now Being Studied _____

Math courses that you have studied in high school or college. Next to each course place your grade.

_____

_____

_____

_____

_____

_____

_____

_____

Schedule - Place an X where you have a course scheduled.

PERIOD	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
8:00					
9:00					
10:00					
11:00					
12:00					
1:00					
2:00					
3:00					
4:00					
5:00					
Evening					

FORM 4: TUTORING CONTRACT (MA-290)

Name _____

Upon the successful completion of the tutoring assignment, the student will receive one hour of college credit.

Assignment and Schedule:

It is understood that the student will attend all scheduled tutoring sessions and all training sessions unless absence is absolutely unavoidable. It is also understood that tutoring responsibilities will be accepted.

Failure to comply with these conditions may result in the student being withdrawn from the course.

Student Signature _____

Faculty Coordinator _____

FORM 5: TUTOR LOG

Name _____

Date	Time In	Time Out	Number of Tutees

FORM 6: TUTEE LOG

Date	Tutee's Name	Math Course	Time In	Time Out	Topic Discussed

FORM 7:

SUNY COBLESKILL

MATHEMATICS LABORATORY TUTEE RECORD

NAME _____ COURSE _____ SECTION _____

I.D.# _____ INSTRUCTOR _____

TUTOR	(1)	(2)	(3)	(4)	(5)
DATE					
TIME	Hrs. ___ Min. ___	Hrs. ___ Min. ___	Hrs. ___ Min. ___	Hrs. ___ Min. ___	Hrs. ___ Min. ___
TOPIC(S) COVERED					
MATERIAL(S) USED					
COMMENTS					

TUTOR	(6)	(7)	(8)	(9)	(10)
DATE					
TIME	Hrs. ___ Min. ___	Hrs. ___ Min. ___	Hrs. ___ Min. ___	Hrs. ___ Min. ___	Hrs. ___ Min. ___
TOPIC(S) COVERED					
MATERIAL(S) USED					
COMMENTS					

FORM 8: MATH FACULTY EVALUATION
OF THE TUTORING PROGRAM

Please check the statements following each item that applies to you. Add comments as necessary.

1. Overall, the tutoring program:
   ___ a. appeared to be used by very few (less than 20%) of my students
   ___ b. appeared to be used by some (from 20% to 50%) of my students
   ___ c. appeared to be used by many (more than 50% of my students
   ___ d. I really couldn't tell if it was used or not by my students

2. Overall, it appeared that the students who went to the Lab:
   ___ a. enjoyed the program
   ___ b. really didn't enjoy the program
   ___ c. didn't indicate their feelings to me

3. Attendance at the Math Lab:
   ___ a. generally helped students
   ___ b. really didn't help
   ___ c. I really don't know if it helped or not
   ___ d. helped students pass the course who might not have passed
   ___ e. kept attrition rates down
   ___ f. improved student attitudes
   ___ g. motivated students to achieve

4. I felt that the tutors:
   ___ a. were knowledgeable
   ___ b. used proper techniques
   ___ c. were responsible

5. The tutor training program:
   ___ a. appeared to help the tutors
   ___ b. was really not needed
   ___ c. I do not know if it was needed or not

6. In general, the tutoring program:
   ___ a. is a worthwhile endeavor
   ___ b. is not worthwhile
   ___ c. I do not know if it is worthwhile or not

Please give comments on your general impression of the overall program. Did it help your students? Suggest improvements.

FORM 9: TUTOR EVALUATION OF THE TUTORING PROGRAM

Let: SA = Strongly Agree
A = Agree
N = Neutral
D = Disagree
SD = Strongly Disagree
C = Have No Opinion

Part I

Indicate your opinion of each of the following statements.

___ 1. I felt that I helped most students who came to the Math Lab.

___ 2. I got along well with the students I tutored.

___ 3. I feel that tutoring has helped me academically.

___ 4. I enjoyed tutoring.

___ 5. I feel that the training program helped me to be a better tutor.

___ 6. I felt prepared for tutoring.

___ 7. The training program was enjoyable.

Part II

Make specific comments and offer specific suggestions for improvement.

1. the general tutoring program

2. the training program

FORM 10: STUDENT EVALUATION OF THE MATH TUTORING PROGRAM

INSTRUCTIONS: Please complete this survey for each item that applies to you. For those items selected, choose the one letter that best describes your opinion or situation.

1. The math course that I am studying is:
   A. MA-101
   B. MA-103
   C. MA-111
   D. MA-112
   E. MA-125
   F. MA-131
   G. MA-231

2. The grade that I expect to receive in my math course is:
   A. A
   B. B
   C. C
   D. D
   E. F

3. The number of times that I sought help in the Math Lab this semester is:
   A. never
   B. seldom (1-3)
   C. a few times (4-6)
   D. frequently (7-12)
   E. on the average of about once a week (13-18)
   F. very often (19 -)

4. I attended the Math Lab:
   A. at various times throughout the semester
   B. mainly during the first half of the semester
   C. mainly during the second half of the semester
   D. mainly during the first few weeks of the semester
   E. mainly during the last few weeks of the semester
   F. mainly during the few weeks near the middle of the semester

5. Probably the most important reason that I attended the Math Lab is:
   A. my teacher suggested it
   B. a fellow student recommended it
   C. I knew I needed help, so I went on my own volition

6. I didn't attend the Math Lab at all because:
   A. I didn't need any help
   B. I could get enough help elsewhere
   C. I heard that the Lab was not a good source of help
   D. the hours were not convenient for me
   E. some other reason

7. I mainly attended the Math Lab:
   A. to get help on assignment problems
   B. to review for tests
   C. some other reason

8. I would describe the tutors as:
   A. helpful and friendly
   B. helpful but not very friendly
   C. not very helpful but they were nice
   D. rather unhelpful and rude

9. I found that the Math Lab:
   A. was an efficient and pleasant place to seek help
   B. was usually overcrowded
   C. had enough tutors, but it was not an efficient and pleasant place to seek help

Please make suggestions on the back of this form that you think will help to improve the Math Lab operation.

FORM 11: TUTOR OBSERVATION

	Yes	No
1. Does the tutor attempt to establish an atmosphere to promote learning:		
a. at the beginning of the meeting?	___	___
b. during the meeting?	___	___
c. at the end of the meeting?	___	___
2. Does the tutor attempt to diagnose the tutee's difficulties?	___	___
3. Does the tutor use an appropriate instructional strategy?	___	___
4. Does the tutor implement the instructional strategy properly?	___	___
5. Does the tutor help the tutee experience some degree of success?	___	___
6. Does the tutor end the session properly?	___	___
7. Does the tutor fill out the appropriate records?	___	___

Overall Tutor Strengths:

Areas of Needed Improvement:

Comments:

APPENDIX B

PEER-TUTOR TRAINER'S MANUAL

Contents:

1. Introduction

2. Schedule

3. Tips for the Trainer

4. The Training Program Outline - Contents, Objectives and Schedule

5. Lessons 1-10

Introduction

This training program is designed to train peer-tutors so that they may help tutees in an efficient and satisfying manner to clearly identify and solve their own particular problems. The content of the program includes the characteristics of the mathematics curriculum at Cobleskill, characteristics of the tutees, program objectives, tutor responsibilities, establishing an atmosphere to promote learning, instructional strategies, tutoring procedures, tutoring practice on common difficulties and on word problems, study skills, and using learning aids. And, just as the instructional strategy that the tutors are trained to use is concentrated at the discovery end of the instructional strategy continuum, the instructional strategy used in the training program is designed to get the tutors deeply involved in the learning process so that they "discover" appropriate procedures to follow.

Throughout the training program:

1. Exposition is kept at a minimum.
2. Trainer talk is kept at a minimum.
3. The trainer mainly clarifies and initiates the training sessions, poses problems, asks questions, and leads discussions.
4. The main instructional strategy is to get the tutors involved in the learning process by using brainstorming and role-playing followed by discussions.
5. Each of the specific exercises has a definite objective, has directions for the trainer to follow, and is clear and uncomplicated. Simplicity is emphasized for all exercises.

Although the training program is designed to meet the objectives at Cobleskill, it can be used as a model for the development of a training program at other institutions.

Schedule

1. Lessons 1-9 are designed in approximately six two-hour time periods during the first three weeks of classes.
2. Three group discussions are held (Lesson 10) after six, ten and fourteen weeks of classes.
3. The observations and private evaluation sessions are scheduled during the tenth week of class.

All meetings are scheduled at mutually (trainer and trainees) convenient times.

Tips for the Trainer

The following trainer tips are adapted from those given by Melaragno (1976).

Leading a Discussion

1. Arrange the group in a circle, around a table, or in a semi-circle facing a blackboard.
2. For a given topic, help the group:
   a. Identify clearly the problem or question.
   b. Arrive at alternate suggestions.
   c. List the suggestions on a blackboard or large sheet of paper.
   d. Decide on the most promising of the suggestions.
3. As a leader:
   a. Clarify situations.
   b. Keep the focus on the topic.
   c. Ask questions to draw out comments or ideas.
   d. Contribute your own ideas after the group has had the opportunity to contribute or as a means of stimulating the discussion.
   e. Be careful not to dominate the discussion.
   f. Try to include silent members in the discussion.
   g. Try not to let individual members of the group dominate the discussion.
4. Reserve time at the end of the discussion to summarize any group decisions.

Steps in Brainstorming

1. Identify the topic for brainstorming. Write it at the top of a blackboard or chart paper.
2. Ask for suggestions.
3. Write the suggestions on the board or paper one at a time, and
   a. repeat the essence of each suggestion
   b. check to be sure that the meaning of the suggestion is clear
4. List all suggestions without evaluation or discussion.
5. If necessary, reorganize the suggestions in meaningful groups.
6. Discuss the suggestions and decide which ones are appropriate and which are inappropriate.

Steps in Role-Playing

1. Describe the situation.
2. Choose the actors.
3. Brief the actors.
4. Assign tasks to the audience as observers.
5. Start the action when all are ready.
6. Cut the action when the point has been illustrated.
7. Discuss what was observed.
   a. Determine what happened.
   b. Ask the actors why they reacted as they did.
   c. Focus on what could have been done differently.
8. Summarize what was learned from the role-playing.

Ending a Lesson

At the end of each lesson the trainer should ask the trainees to evaluate the lesson.

1. Was the lesson worthwhile? What was good? What was bad?
2. What did the trainees learn?
3. How can the lesson be improved?

The trainer should keep a record of the trainees evaluation as well as his own opinion of the lesson for future consideration.

Trainee Sheets

All handouts should be kept in individual trainee folders for future reference.

THE TRAINING PROGRAM OUTLINE

(Note: A copy of the outline should be given to each trainee at the first lesson.)

1. LESSON 1: INTRODUCTION: THE COMPONENTS OF THE TRAINING PROGRAM (51 min.)

   Exercise 1. Making a Hat - Objective: Introduce the trainees to the components of the program.

   Schedule: _____

2. LESSON 2: BASIC BACKGROUND ON THE MATH CURRICULUM, TUTEES AND TUTORING OBJECTIVES (60 min.)

   Exercise 2. The Math Curriculum - Objective: Familiarize the trainees with the math program.

   Schedule: _____

   Exercise 3. Tutee Characteristics - Objective: Acquaint the trainees with potential tutee characteristics.

   Schedule: _____

   Exercise 4. Overall Tutoring Program Objectives - Objective: To have the trainees fully comprehend the objectives of the tutoring program.

   Schedule: _____

3. LESSON 3: TUTORING RESPONSIBILITIES (35 min.)

   Exercise 5. Job Responsibilities - Objective: To have the trainees fully comprehend their responsibilities.

   Schedule: _____

4. LESSON 4: ESTABLISHING AN ATMOSPHERE TO PROMOTE LEARNING (120 min.)

   Exercise 6. Characteristics of Good and Bad Teachers - Objective: To have the trainees personally relate to good and bad teaching characteristics and to make suggestions.

   Schedule: _____

Exercise 7. Procedures for Establishing an Atmosphere that Promotes Learning - Objective: To have the trainee learn appropriate procedures for establishing an atmosphere that promotes learning.

Schedule: _____

Exercise 8. Starting a Tutoring Session - Objective: To offer the trainees practice using appropriate ways to start a session.

Schedule: _____

Exercise 9. Facilitative Responses - Objective: To familiarize the trainees with appropriate responses to tutee comments and to offer the opportunity to practice responses.

Schedule: _____

Exercise 10. A Treasure Hunt - Objective: To offer the trainees the opportunity to practice their skills in establishing an atmosphere that will promote learning so that they can improve their skills.

Schedule: _____

5. LESSON 5: INSTRUCTIONAL STRATEGIES (140 min.)

Exercise 11. Types of Difficulties that the Tutor will Encounter - Objective: To acquaint the trainee with the instructional strategies that should be used for various types of difficulties that tutees will have.

Schedule: _____

Exercise 12. Getting the Learner Involved - Objective: To convince the trainees of the necessity of learner involvement.

Schedule: _____

Exercise 13. The Listening Strategy - Objective: To have the trainees learn and practice the listening instructional strategy.

Schedule: _____

Exercise 14. Teaching by Asking Questions - Objective: To have the trainees learn and practice the questioning instructional strategy.

Schedule: _____

6. LESSON 6: TUTORING PROCEDURES (30 min.)

Exercise 15. A Summary of Tutoring Procedures - Objective: To establish a list of appropriate tutoring procedures.

Schedule: _____

7. LESSON 7: TUTORING PRACTICE (as convenient)

Exercise 16. Tutoring Common Mathematical Difficulties - Objective: To give the trainees practice so that they may improve their skills.

Schedule: _____

Exercise 17. Tutoring Verbal Problems - Objective: To offer the trainees suggested procedures for solving verbal problems and to offer them the opportunity to practice their tutoring skills.

Schedule: _____

8. LESSON 8: STUDY SKILLS (35 min.)

Exercise 18. Suggested Study Procedures - Objective: To familiarize the trainees with appropriate study procedures so that they may suggest them to tutees.

Schedule: _____

9. LESSON 9: LEARNING AIDS (35 min.)

Exercise 19. The Use of Learning Aids - Objective: To familiarize the trainees with the use of the lab-based learning aids.

Schedule: _____

10. LESSON 10: TUTOR DISCUSSIONS (as needed)

Exercise 20. Group Discussion - Objective: To give the tutors the opportunity to improve their skills by discussion problems that they encountered during actual tutoring sessions and the opportunity to evalnate the program at the end of the semester.

Schedule: Three one-hour periods.

Exercise 21. Tutor Observation and Evaluation -
Objective: To give the tutor the opportunity to improve by observing the tutor in actual practice and discussing the observation in a private evaluation session.

Schedule: _____

NOTE: Schedules will be completed after the tutors are selected. Schedules must match the tutor's academic schedule.

LESSON 1. INTRODUCTION: THE COMPONENTS OF THE TRAINING PROGRAM

(Approximate Time: 51 min.)

Exercise 1. Making a Hat

Background: Tutors may not appreciate the need for their participation in a training program. After all, "everyone knows how to teach." In keeping with the overall strategy of the training program, this exercise is designed to have the trainees suggest the necessary components of a training program.

Specific Objective: The objective of this exercise is to familiarize the trainees with the essential components of a training program. The exercise and following discussion are designed to introduce the entire training program to the tutors.

Agenda:

Activity	Approximate Time	Materials
1. Welcome trainees to the training program.	5 min.	Program Outline
2. Role-Play: A teacher (trainer) teaching a class (trainees) how to make a hat (use Direction for Making a Paper Hat).	3 min.	8½" x 11" sheet of paper for each person.
3. Role-Play: A tutor (trainer) helping students (trainees) to make a hat, I.	3 min.	Sheet of paper for each person.
4. Discussion: What was bad about the teaching and tutoring?	10 min.	
5. Brainstorm: Suggested steps for a tutoring session.	10 min.	

6.	Discussion: Essential Components	10 min.	Trainee Sheet 1
7.	Role-Play: A tutor (trainer) helping students (trainees) to make a hat, II.	5 min.	
		46 min.	

Lesson Evaluation: (5 min.)

Trainer Notes for Lesson 1.

Agenda (Exercise 1):

1. Initial welcome should be brief. Discuss Program Outline.

2. The teacher should try his best to do a poor job of teaching the paper folding. Show the paper folding very quickly. Don't allow questions. Don't give the students their paper until after the lesson is taught. Hopefully, students will not be able to make the hat.

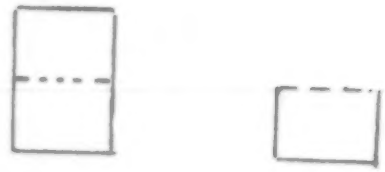
3. The tutor should follow the same procedures as in Step 2. Try to do a poor job. When the students are working, criticize their work, be sarcastic, and don't answer questions.

6. After the discussion of agenda items 3 and 4, discuss the items listed on Trainee Sheet 1. Compare it to the list made for Step 5. Do not go into great detail on each component.

7. The tutor should attempt to follow the components given on Trainee Sheet 1.

Directions for Making a Paper Hat

1. Fold a piece of 8½" x 11" paper in half so that the 11" side is divided in half.



2. Fold the upper left corner and upper right corner as shown. Be sure point is half-way along the crease and the folds fit neatly.

3. Fold bottom flaps up on each side. The front flap goes to the front and the back flap goes to the back.

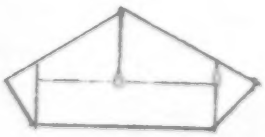
4. Fold top corners of the front flap inside the back flap and then fold the top corners of the back flap over the front flap.

5. Fold in half over the fold made in Step 2.

6. Open and push the end corners to the center so that the hat folds and the side creases are now in the middle.

7. Fold the bottom corners up as shown; front to front and back to back.

8. Pull the front forward and the back backward and turn the hat so that the original front is now again the front.



9. Open up the bottom slightly. The hat is done and can be worn (if you have a small head).

NOTE: The trainer should practice making the hat so he can do it very quickly.

Trainee Sheet 1.

Title: Essential Components for an Effective Training Program

1. The tutors should have a full understanding of:
   a. the characteristics of the mathematics curriculum
   b. the characteristics of the tutees
   c. the overall tutoring program objectives
2. The tutors should know their specific responsibilities.
3. The tutors should know how to establish an atmosphere to promote learning.
4. The tutor should be able to use an instructional strategy that involves students in the learning process.
5. The tutor should be able to follow established tutoring procedures.
6. Tutors need to practice their tutoring techniques.
7. Tutors need to have a good understanding of the math content that they will tutor especially in the areas of common algebraic difficulties and the solution of word problems.
8. Tutors should be able to instruct students on how to use the learning aids in the Math Lab.
9. Tutors should be able to suggest appropriate study techniques for tutees.
10. Tutors should have the opportunity to discuss difficulties that they encountered while tutoring.
11. Tutors should have the opportunity to have their tutoring skills evaluated. The evaluation should then be discussed with the tutor.

LESSON 2. BASIC BACKGROUND ON THE MATH CURRICULUM, TUTEES, AND TUTORING OBJECTIVES

(Approximate Time: 60 min.)

Exercise 2. The Math Curriculum

Background: Tutors should be familiar with the content and basic objectives of each course offered by the Math Department. Such a familiarity will enable the tutors to help the tutees toward appropriate objectives.

Specific Objective: The objective of the exercise is to familiarize the trainees with each of the course offerings of the Math Department.

Agenda:

Activity	Approximate Time	Materials
1. Discussion: The Math Curriculum	15 min.	Trainee Sheet 2

Exercise 3. Tutee Characteristics

Background: Since the tutors will be math students with relatively high math ability they may not appreciate the needs and concerns of the potential tutees. Tutors should be aware of the tutees' needs and concerns so they do not alienate them in the tutoring process.

Specific Objective: The objective of the exercise is to acquaint the tutor with reasons that tutees come for help and with potential academic and socio-psychological tutee characteristics.

Agenda:

Activity	Approximate Time	Materials
1. Brainstorm: Why do students come to the Math Lab for tutoring?	5 min.	
2. Discussion: Reason for using the Math Lab.	5 min.	Trainee Sheet 3
3. Brainstorm: What are potential academic and socio-psychological tutee characteristics?	10 min.	
4. Discussion: Tutee Characteristics	5 min.	Trainee Sheet 4
	25 min.	

Exercise 4. Overall Tutoring Program Objectives

Background: The trainees should be able to use the math course objectives and the tutee characteristics to suggest meaningful program objectives.

Specific Objective: The objective of this exercise to have the trainees fully comprehend the objectives that have been established by the Mathematics Department for the overall tutoring program.

Agenda:

Activity	Approximate Time	Materials
1. Brainstorm: Based upon the work done in Exercise 2 and 3 what should the objectives of the tutoring program be?	5 min.	Trainee Sheet 5
2. Discussion: Objectives set by the Mathematics Department	10 min.	Trainee Sheet 5
	15 min.	

Lesson Evaluation: (5 min.)

Trainer Notes for Lesson 2.

Agenda (Exercise 2):

1. A brief expository presentation explaining the course offerings should be made. Emphasis should be placed on MA 101 and MA 111. Emphasize that the courses do not concentrate on mathematical rigor.

Agenda (Exercise 3):

1. During the discussion of suggestions ask the trainees, "On what type of student should you concentrate your energies?" Keep a list on the blackboard for future reference.

2. Summarize discussion by suggesting polite refusals of help and referrals for some types of students. Emphasize reasons 6, 7 and 8 on Trainee Sheet 3. Have trainees fill in other suitable reasons on their trainee sheets.

3. Emphasize that tutors should not pre-judge tutees. Keep list on the board for future reference.

Agenda (Exercise 4):

1. Ask trainees to refer to the lists discussed in Exercises 3 and 4 and then to write a statement of program objectives. Fold bottom part of Trainee Sheet 5 under so that it cannot be seen by the trainees.

2. Emphasize the meaning of the word "remedial" - not new work. Emphasize that these are the objectives that will be followed.

Trainee Sheet 2.

Title: The Math Curriculum - Basic * Course Offerings

Basic Sequence:

Title	Prerequisite	Content-Objectives
MA 101 - Elementary Algebra (3 credits)	0 - 1 year of H. S. math	Basic Algebraic Skills
MA 111 - Intermediate Algebra (3 credits)	2 years of H.S. math or MA 101	Problem Solving Applications
MA 112 - Trigonometry (3 credits)	MA 111 or the equivalent	Trigonometric Skills Applications
MA 131 - Precalculus (3 credits)	Math 11 in H. S. or MA 112	Function Concept and Advanced Algebraic Skills
MA 231 - 234 (4 credits each)	MA 131 or 4 years of H. S. math, etc.	Calculus Skills, Concepts, and Applications

Electives:

Title	Prerequisite	Content-Objectives
MA 010 - Arithmetic (1 credit)	None	Basic Arithmetic Skills
MA 103 - Math. of Finance (3 credits)	MA 101 or equivalent	Business Applications
MA 104 - Topics from Mathematics (3 credits)	MA 101 or equivalent	A Basic Understanding of Selected Math Topics
MA 125 - Statistics (3 credits)	MA 111 or equivalent	Statistical Concepts
MA 221 - Finite Math with Applications	MA 131 or 4 years of H. S. math or the equivalent	Mathematical Concepts

*MA 225 and MA 105 are not included.

Trainee Sheet 3.

Title: Potential Reasons for Students to Come to the Math Lab.

Trainer Suggestions:

1. Looking for a friend.
2. Looking for someone who will discuss personal problems.
3. Looking for someone who will discuss general academic problems.
4. Looking for someone to teach him mathematics due to class absence, inattention, or a general dislike for his teacher.
5. Reluctance to ask questions in class.
6. Needs help with homework.
7. Needs help with test corrections.
8. Needs help reviewing for a test.

Others:

Trainee Sheet 4.

Title: Potential Tutee Characteristics

Socio-psychological:

1. Failure oriented.
2. Highly motivated - comes for help on his own.
3. Low motivation - comes for help at someone else's suggestion.
4. Really doesn't want help.
5. Low self-confidence.
6. Dislike for teacher.
7. Is shamed by his need for help.

Others:

Academic:

1. Low math ability.
2. Poorly prepared for seeking help.
3. Doesn't like math.

Others:

Trainee Sheet 5.

Title: Program Objectives

As a tutor, you cannot be expected to solve every personal problem for every student who seeks your help. Tutors, just as classroom teachers, are not "magicians." The tutoring program must have very specific objectives that it has good chances of accomplishing. If the program attempts to do too much, perhaps it will do nothing.

Based on your discussions in Exercises 2 and 3, write specific objectives for the peer-tutoring program.

- -

FOLD UNDER SO TRAINEE CANNOT SEE

- -

Best Tutoring Program Objectives set by the Math Department.

The tutoring program is designed to offer remedial tutoring to students who voluntarily seek help with specific mathematical difficulties that they encounter with assignements, review work, and test corrections.

LESSON 3. TUTORING RESPONSIBILITIES

(Approximate Time: 35 min.)

Exercise 5. Job Responsibilities

Background: There are certain duties and responsibilities associated with being a tutor in an efficiently operated Math Lab. These responsibilites must be followed by tutors. For example, tutors who do not arrive promptly for scheduled appointments discourage students who need their help from seeking help.

Specific Objective: The objective of this exercise is to have the trainees fully comprehend their responsibilities and to convince them of the necessity that the responsibilities be followed.

Agenda:

Activity	Approximate Time	Materials
1. Independent Brainstorming: The Responsibilities of a Newly Hired Shoe Salesman.	10 min.	Trainee Sheet 6
2. Independent Brainstorming: The Responsibilities of a Tutor.	10 min.	Trainee Sheet 6
3. Discussion: Tutor Responsibilities.	10 min.	Trainee Sheet 7
	30 min.	

Lesson Evaluation: (5 min.)

Trainer Notes for Lesson 3.

Agenda (Exercise 5):

1. Ask the trainees to read the "Shoe Salesman" introductory statement on the top of Trainee Sheet 6 and to follow the given directions. After five minutes make a single list on the board from the suggestions of the trainees. Attempt to categorize the suggestions. For example, promptness, friendliness, record keeping,....

2. Follow a similar procedure for the "Tutor" introductory statement in the middle of Trainee Sheet 6.

3. Discuss the responsibilities of tutors as given on Trainee Sheet 7. Compare that list to the ones made by the students. Emphasize the importance of following the responsibilities. Expand on each of the responsibilities briefly, so that the trainees will be able to intuitively follow them during their initial tutoring sessions.

Trainee Sheet 6.

Title: The Responsibilities of a Shoe Salesman

Statement:

Every job has certain responsibilities associated with it that must be followed.

Directions:

Pretend that you are the manager of a shoe store and you are hiring a new salesman. List some responsibilities that are associated with the job.

The Responsibilities of a Tutor

Statement:

Being a tutor is just as much a job as being a shoe salesman. Tutoring has certain responsibilities associated with it that must be followed.

Directions:

List the specific job responsibilities that you believe to be associated with being a tutor.

Trainee Sheet 7.

Title: Tutoring Responsibilities

If the Math Lab is to be successful in helping students, then tutors must follow certain responsibilities. It is perfectly alright to be creative as long as your actions are within the following guidelines:

1. Tutors must arrive at work on time.

   When tutors are late for appointments students are discouraged from seeking help.

2. When absence from work is absolutely unavoidable, a tutor should call a librarian and ask to have a notice posted that you cannot work.

   Again, you do not want to inconvenience students. They are your customers.

3. Special tutors must maintain contact with their assigned teacher so they are aware of classroom activities.

   Tutors must be prepared to help.

4. Tutors must maintain all required records.

   The Mathematics Department wants to have the best possible tutoring program. It has to know who is using it, how much it is being used and why it is being used so that the program can be evaluated and then improved.

   a. Fill in your tutor log when you arrive at work and when you leave work.

   b. Fill in the tutee log when the tutee enters and when he leaves.

   c. Fill in the individual tutee record when the tutee leaves.

5. Tutors must do their best to promote a laboratory atmosphere that is conducive to learning.

   Students must enjoy coming to the lab for help. If they are alienated by the activities in the lab, then they will not come for help. And, all your training and our efforts are wasted. Specific procedures will be discussed in the next lesson.

6. Tutors must give the individual tutee his undivided attention.

   Tutor one student at a time. If two friends come in for help on the same problem, then you can help them together. That is the one exception. If others ask for help when you are busy, ask them to wait. Tutor one student (for at most 20 minutes) while others are waiting. When tutoring, give the tutee your undivided attention. The tutee is supreme.

7. Tutors must follow the instructional strategy set by the Mathematics Department.

   Tutors are not trained teachers. Your job is to help students learn familiar content and skills by getting them involved in the learning process. A specific strategy will be discussed in a future lesson.

8. Tutors must follow the tutoring procedures (steps in the tutoring process) set by the Math Department.

   The objectives of the tutoring program indicate a limited role for a tutor and it is important that the tutor confine his activities to accomplishing these objectives. To accomplish these objectives specific procedures must be followed. These procedures should not stifle creativity. They should offer guidelines to follow. Specific procedures will be discussed in a future lesson.

9. Tutors must know now to use the learning aids that are based in the Math Lab.

10. If any serious problems arise that you think deserve the immediate attention of the Math Lab Director, contact D. Cohen or R. Cameron as soon as you can. Otherwise, keep track of problems for discussion at training sessions.

11. A tutor must not go "over the teacher's head." He must follow the methods used by the classroom teacher. In addition, the tutor must <u>not</u> take sides in teacher-student disputes.

    An appropriate relationship must be maintained between the teacher, student, and tutor. The tutor's job is to help the student learn material and skills the way that the classroom teacher wants them learned.

12. Tutors must attend the training sessions and do their best to learn how to tutor.

    Tutoring is not doing "what comes naturally." There are specific skills and procedures to learn.

13. The tutor must follow the given responsibilities.

LESSON 4. ESTABLISHING AN ATMOSPHERE THAT PROMOTES LEARNING

(Approximate Time: 120 min.)

Exercise 6. Characteristics of Good and Bad Teachers

Background: The trainees have encountered teachers who they liked and teachers who they did not like. In this exercise the trainees are asked to think about the characteristics of the two types of teachers. The lists of characteristics serve as a starting point for suggestions on how tutors should behave in order to establish an atmosphere that promotes learning.

Specific Objective: The objective of this exercise is to have the trainees think about good and bad teaching characteristics.

Agenda:

Activity	Approximate Time	Materials
1. Independent Brainstorming: Characteristics of Good and Bad Teachers.	15 min.	Trainee Sheet 8

Exercise 7. Procedures for Establishing an Atmosphere that Promotes Learning

Background: Unless students enjoy coming to the Math Lab for help, the tutor's time is wasted. You can't tutor when you do not have tutees. The tutors must take advantage of the fact that they are peer-tutors to establish an atmosphere in the Math Lab that encourages students to seek help.

Specific Objective: The objective of this exercise is to have the trainees learn procedures for establishing an atmosphere that promotes learning.

Agenda:

Activity	Approximate Time	Materials
1. Discussion: Procedures for Establishing an Atmosphere that Promotes Learning.	15 min.	Trainee Sheet 9

Exercise 8. Starting a Tutoring Session

Background: At the beginning of each tutoring session the tutor should introduce himself to the tutee, find out the tutee's name, and engage in some small-talk about tutee interests. During the conversation the tutor should concentrate on listening to the tutee so that he will remember the tutee's name and some interests that the tutee has.

Specific Objective: The objective of this exercise is to give the tutor practice in initiating a tutoring session in a friendly way.

Agenda:

Activity	Approximate Time	Materials
1. Role-Play Dyads: Tutor-Tutee Introductions.	15 min.	
2. Discussion: Thoughts of the Tutor During the Introduction Process.	5 min.	
	20 min.	

Exercise 9. Facilitative Responses

Background: A tutee will make many statements during a conversation with a tutor for which he expects a tutor response. The response that the tutor makes can be acceptable or even helpful to the tutee. Or, it can alienate the tutee. Certainly, the tutor wants to make responses that will facilitate learning.

Wittmer and Myrick (1974) discuss potential facilitating responses to student statements in their book entitled Facilitative Teaching: Theory and Practice. An outline of their suggestions is given on Trainee Sheet 11.

Specific Objective: The objective of this exercise is to familiarize the trainees with facilitative responses to tutee statements and to practice their use.

Agenda:

Activity	Approximate Time	Materials
1. Brainstorming: Facilitative Responses	15 min.	Trainee Sheet 10
2. Discussion: Suggested Responses to Facilitate Learning	15 min.	Trainee Sheet 11
3. Brainstorming: Facilitative Responses	10 min.	
	40 min.	

Exercise 10. A Treasure Hunt

Background: Trainees need to practice procedures for establishing an atmosphere to promote learning. The "Treasure Hunt" tests a trainee's ability to implement appropriate procedures.

Specific Objective: The objective of this exercise is to offer the trainees the opportunity to practice and observe activities that establish an atmosphere that promotes learning.

Agenda:

Activity	Appropriate Time	Materials
1. The Treasure Hunt Game	10 min.	Trainee Sheets 9 and 12 and a deck of cards.
2. Discussion: A Critique of Procedures.	15 min.	
	25 min.	

Lesson Evaluation: (5 min.)

Trainer Notes for Lesson 4.

Agenda (Exercise 6):

1. List the suggested characteristics of good teachers on the board. Cross out those characteristics having to do with subject-matter knowledge. Highlight those suggestions that had to do with establishing an atmosphere that promotes learning. Ask students to rationalize their suggestions. Leave the list on the board.

Agenda (Exercise 7):

1. Discuss each of the suggested procedures and offer a rationale for each procedure. Attempt to relate the procedures to the list made in Exercise 7.

Agenda (Exercise 8):

1. Divide the trainees into pairs. Denote one tutee and one tutor in each pair. Ask the tutor to pretend that the tutee had just walked into the Math Lab and he is to introduce himself to the tutee and engage in some small-talk for a few minutes. After a few minutes gather the group together and ask each tutor to state the tutees name and the points of their conversation. Emphasize the fact that careful listening is necessary. Discuss with the group the appropriateness of the topics discussed in the small talk. Ask each tutee how he felt about the conversation.

2. Ask each tutor if he recalls thinking about anything other than the tutee during their conversation. Emphasize that a tutor must give full attention to a tutee.

Agenda (Exercise 9):

1. Explain to the trainees that the type of response that they make to a tutee's statement can either facilitate or hinder learning during a tutoring session. Ask the trainees to make three appropriate responses (single sentences) and three inappropriate responses to Statement 1 on Trainee Sheet 10. List several examples in each category on the board. Ask for rationales for each suggestion.

2. Have students read Trainee Sheet 11. Then categorize responses made in Activity 1.

3. Ask students to make facilitative responses to the remaining statements on Trainee Sheet 10. Discuss the suggestions. For Statement 4, ask the trainees whether or not the tutor should get involved and personally approach the student's teacher. Discuss responses. Emphasize--don't take sides in disputes.

Agenda (Exercise 10):

1. Choose a tutor and tutee. Hand Trainee Sheet 10 to all trainees except the tutee. Discuss game direction. Ask everyone to take a moment and review Trainee Sheet 9. Suggest to the trainee that he use facilitative methods during the game. Ask the observers to take notes on the way so that the tutor may attempt to establish an atmosphere to promote learning. Tape record the comments made during the game. After the game ask the tutee how he felt about the instructions.

2. Ask the observers to comment on the procedures that the tutor used. Was the tutor patient? Did the tutor encourage the tutee when he made errors? Play back the tape to substantiate comments.

Trainee Sheet 8.

Title: Characteristics of Good and Bad Teachers

During your educational careers you have encountered teachers who you really liked. You liked their teaching methods, their personality and the way that they treated you. You probably looked forward to attending their classes. On the other hand, you probably encountered teachers that you didn't particularly care for. You were especially disenchanted with attending their classes.

As tutors you will certainly want to model your style after those teachers who you particularly enjoyed and certainly avoid doing the characteristics associated with those teachers who you didn't care for.

List the characteristics that you associate with good teachers.	List the characteristics you associate with poor teachers.

Trainee Sheet 9.

Title: Procedures for Establishing an Atmosphere that Promotes Learning

1. Establish a Friendly Atmosphere

   Take advantage of the fact that you are a peer to the tutee. Get to know him student-to-student.

   a. Welcome the tutee when he enters the Math Lab.

   b. Introduce yourself and find out his name. Throughout the session call the tutee by name.

   c. Engage in some "small-talk" before getting to the tutee's math difficulty. Make the tutee feel relaxed. Talk about his interests. However, don't probe.

   d. Concentrate on listening to what the tutee has to say. Try to let the tutee do most of the talking. Concentrate on remembering what you talked about so that next time you meet the tutee you can relate to him as a friend.

   e. Reply to tutee comments cautiously. Use facilitative responses. (See Exercise 9.)

2. Be Aware of the Tutee's Feelings

   Tutees may be very "thin skinned." They may feel that it is degrading having to ask a peer for help.

   a. Treat the tutee as an equal. You are just a friend who is helping him out. Sit on the side of him, rather than facing him as a teacher.

   b. Give the tutee your full attention. Make him feel that he is important. He is the center of your attention.

   c. Be sure that the tutee feels that he is liked.

   d. Accept the student as he is.

   e. Let him know that he doesn't have to worry about making mistakes.

f. Don't take sides in any dispute that the student has with his teacher.

g. Give the tutee the feeling that you can be trusted not to divulge confidential statements.

3. During the Help Session

The primary reason that the tutee came to the Math Lab was for help with a math-related difficulty. All of the tutor's actions and statements during the help statement should be made in a positive and encouraging way.

a. Listen carefully during the help session.

b. Be very patient. Don't rush.

c. Praise the tutee when he answers a question correctly or makes some progress. Don't criticize wrong answers.

d. Be encouraging.

e. Let the tutee know that you have confidence in him.

f. Be sure that the tutee experiences some success by starting the help session with material that the tutee knows.

g. At the end of each help session the tutee should have a sense of accomplishment.

h. Build up the tutee's self-confidence by expressing your faith that he can succeed.

i. Empathize with the problems the tutee is having.

j. Don't be condescending.

4. At the End of the Session

a. Let the tutee know that he is welcome to return.

b. Don't expect a "thank-you" for your efforts.

Trainee Sheet 10.

Title: Facilitative Responses to Tutee Statements

Directions: List several potential responses to each statement.

1. Everything I do is wrong. I'm the dumbest person in class. I think my classmates laugh at me behind my back. I'm so dumb.

2. I hate math. My parents never did well at it and I can't do well either. The only reason I'm in this course is that it is required.

3. I don't really want to be tutored. I'm here because my teacher made me come.

4. My teacher stinks. I hate him. He made a mistake correcting my paper and when I asked him about it, he won't even fix up his mistake.

Trainee Sheet 11.

Title: Facilitative Responses

Wittmer and Myrick[1] suggest the following types of potential responses:

Statement:

Everything I do is wrong. I'm the dumbest person in class. I think my classmates laugh at me behind my back. I'm so dumb.

1. Advising and Evaluating - You are going to have to learn to be more objective and not so sensative.

   Advising - Tell person what to do
   Evaluating - Give your opinion > Suggest an appropriate action

2. Analyzing and Interpreting - It is difficult for you to discuss your math problems with others because you think they will make fun of you.

   Analyze - Attempt to find reasons for the behavior
   Interpret - Explain how you see the behavior > Explain behavior

3. Reassuring and Supporting - There is nothing wrong with feeling the way you do. I often feel dumb.

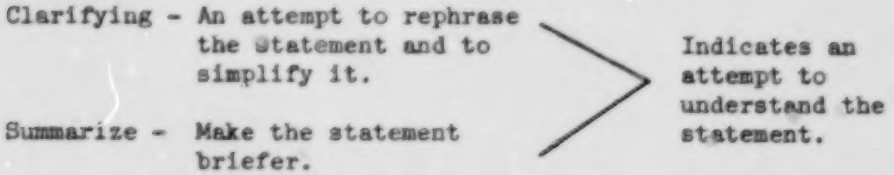
   Reassuring and Supporting - A statement that implies that you have confidence that he will solve his problem.

4. Questioning - What would be a better way to feel about your work?

   Questioning - Designed to seek additional information.

[1]Wittmer, J. and Myrick, R.D. Facilitative Teaching: Theory and Practice. Pacific Palisades, CA: Goodyear, 1974.

5. Clarifying and Summarizing - I think your saying that you don't like the way that you feel about school.


Clarifying - An attempt to rephrase the statement and to simplify it.
Summarize - Make the statement briefer.
Indicates an attempt to understand the statement.

6. Reflecting Feeling - You are probably embarrassed to have to make that statement.

Reflecting - A verbalization of how you think the student feels. Echos a feeling.

Others:

7. Silence
8. Encouragement
9. Sarcasm and Ridicule
10. Scolding and Threats
11. Confrontation
12. Humor

Which Responses are Appropriate?

1. Don't give advice unless you are specifically asked for it. Advice can be threatening. Student may feel that he must follow it.

2. People don't like to have others try to read their mind. When you analyze a statement you may project your own attitudes into the situation.

3. Reassuring responses can make the student feel that you don't think his problem is important or that he shouldn't feel the way that he does.

4. Questioning is a good instructional technique but as a response it may make the student feel that he is being cross-examined. Only ask questions if they serve a very good purpose.

5. Clarification statements can be helpful when the student is not sure that you are following his ideas or even interested in his ideas. A clarification statement lets the tutee know that he has your attention and puts the responsibility back on the student for carrying on the conversation. In general, it is better for the tutee to talk and the tutor to listen. Let the tutee solve his own problems.

6. The reflecting statement is very difficult to learn. It demands that you be empathetic. Students like to have their feelings understood, but if you are not sure of the student's feelings don't attempt to inject your own attitudes. You may want to ask a simple question so the student can explain his feelings.

7. Silence is appropriate at times. However, sometimes students expect a response.

8. Encouragement can help if you feel that it is needed.

9. Don't ridicule or be sarcastic.

10. Don't scold or threaten.

11. Don't confront the student with an order.

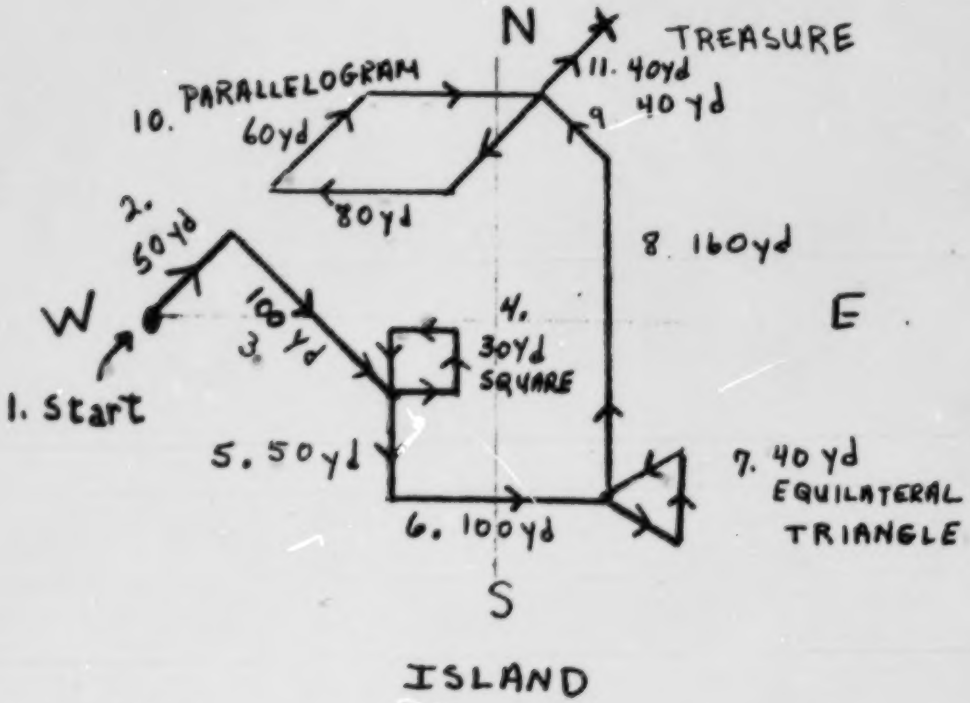
12. Timely humor can be helpful, but don't make light of a serious situation.

In general, it is up to the responder to decide upon the type of response that is appropriate for a certain situation. No one response is always appropriate.

Trainee Sheet 12.

Title: The Treasure Hunt Game

The objective of the game is to have a tutee draw a map that can be used to find a buried treasure.



Directions:

1. Tutor attempts to explain to a tutee how to draw a scale map(10yds. = 1 in.), Tutee is at the board. He cannot see the map.

2. Tutor must proceed one step at a time. Giving directions and then waiting for a response. If the response is correct, he goes to the next step. If it is incorrect, he should repeat the direction or attempt to make the directions more meaningful and let the tutee respond again.

3. The tutor can describe geometric shapes, describe direction of path using compass directions, and describe length of path.

4. The tutor should not give further directions between a direction and response. He should attempt to establish an atmosphere that promotes learning.

5. After each direction the tutee should take a card from a deck of cards. If it is a picture card or an ace, he should purposely make a wrong response. Otherwise, he should attempt to follow directions.

6. When the map is completed the game ends.

LESSON 5. INSTRUCTIONAL STRATEGIES

(Approximate Time: 140 min.)

Exercise 11. Type of Difficulties that the Tutor Will Encounter

Background: A student can seek help in the Math Lab for several types of problems. The trainees should be encouraged to attempt to help with those problems that are within their province. Tutors should refer students who have deep personal problems, general academic problems, and poor study skills to a counselor or to the student's advisor. Deep mathematical misunderstandings, work that is new to the student, or math problems that are beyond the scope of the tutor's knowledge should be referred to the tutee's teacher.

Specific Objective: The objective of this exercise is to acquaint the trainees with the types of problems that potential tutees will bring to the Math Lab and to suggest appropriate instructional strategies to follow.

Agenda:

Activity	Approximate Time	Materials
1. Brainstorm: Suggest Instructional Strategies, I.	10 min.	Trainee Sheet 13
2. Discussion: Suggested Instructional Strategies for Specific Types of Problems.	10 min.	Trainee Sheet 14
3. Brainstorm: Suggest Instructional Strategies, II	10 min.	Trainee Sheets 13 and 14
	30 min.	

Exercise 12. Getting the Learner Involved

Background: Tutors are to do their best to involve tutees in the learning process. This exercise is designed to convince the trainees of the necessity of student involvement in the learning process.

Specific Objective: The objective of this exercise is to attempt to convince the trainees of the necessity of student involvement in the learning process.

Agenda:

Activity	Approximate Time	Materials
1. The Container Puzzle	20 min.	Trainee Sheet 15
2. Discussion: Implication of Results	10 min.	
	30 min.	

Exercise 13. The Listening Strategy

Background: In order for the trainees to appreciate the suggested strategies, they must "discover" the contributions they can make to the instructional process.

Specific Objective: The objective of this exercise is to have the trainees learn and practice the listening instructional strategy.

Agenda:

Activity	Approximate Time	Materials
1. The Find the Error Game	20 min.	Trainee Sheets 16 and 17

Exercise 14. Teaching by Asking Questions

Background: Tutors have the responsibility of getting the learner involved in the learning process. One way to "force" learner involvement is to use an instructional strategy that emphasizes the use of questions rather than simply giving information or showing the learner how to do something.

The asking of "good" questions in an appropriate manner is a skill that must be developed through practice.

Specific Objective: The objective of this lesson is to have the trainees learn techniques for asking questions that will involve students in the learning process and to offer them the opportunity to practice asking questions.

Agenda:

Activity	Approximate Time	Materials
1. A Lesson on Questioning: Types and Procedures	10 min.	Trainee Sheet 18
2. A Demonstration of Questioning	15 min.	
3. Discussion: Types of Questions and Procedures	10 min.	Trainee Sheets 19 and 20
4. Role-Play: Teaching by Asking Good Questions	20 min.	Scissors
	55 min.	

Lesson Evaluation: (5 min.)

Trainer Notes for Lesson 5.

Agenda (Exercise 11):

1. Ask students to read Trainee Sheet 13 and to suggest instructional strategies. Discuss the suggestions.

2. Read Trainee Sheet 14 with the trainees and discuss the suggested strategies.

3. Ask the students to refer back to Trainee Sheet 13 and to categorize each problem. Then discuss appropriate strategies with the trainees.

Agenda (Exercise 12):

1. Split the trainees into two equal groups: A and B. Ask Group B to leave the room for a few minutes. Give Trainee Sheet 15 to each trainee in Group A. Ask them to read the introduction. Give them a minute to solve the puzzle - measure 6 qts. from a 5 qt. and 7 qt. container. Show the students who do not solve the puzzle how to measure 4 qts. from a 3 qt. and 5 qt. container. Then ask the students who did not solve the original puzzle to try again. Measure the average length of time it takes them to succeed.

   Recall Group B to the room. Repeat the same procedures with them except involve the students in learning how to solve the second puzzle by asking them questions. At the end, explain to Group B what you did with Group A.

2. Discuss results and their implications.

Agenda (Exercise 13):

1. Divide the trainees in two equal groups: A and B. Distribute Trainee Sheet 16 face down. Explain to Group A that they are to attempt to find the error on Trainee Sheet 16 by individually reading through the work. Pair individuals in Group B. One person in each pair is the listening tutor and the other person in each pair is the working tutee. The tutee should rework the problem at the bottom of the page and explain his steps to the listener. He should refer to the given work after each step to see if he can find the error. When all are ready, ask each worker to time the length of time it takes him to find the error. Signal the workers to start.

When most people have found the error signal an end. Record times.

Switch group activities for the groups and repeat using Trainee Sheet 17.

Call the students attention to the fact that this is not exactly like listening to a tutee because the tutee did not make the original error.

Tally average time per work. Which is more efficient? Discuss feelings of people working alone and people working with a listener.

Agenda (Exercise 14):

1. Ask the trainees to read Trainee Sheet 18.

2. Demonstrate good questioning practices by tutoring a trainee. Ask the other trainees to observe the activities. Tape the lesson.

Topic: Interest Rates for Installment Buying

Problem: Find the interest rate charged on the installment purchase of a $300 t.v. (cash price) that can be purchased for $60 down and six monthly payments of $45.

Solution:

1. Installment Price - $60 + 6 x $45 = $330

2. Cost of Installment Plan - $330 - $300 = $ 30

3. Amount Borrowed - $330 - $30 - $60 = $240 (Principal)

4. Each Payment - $\frac{\$240}{6}$ = $40 (Payment on Principal) Plus $5 Interest

5. Length of Time Money Borrowed - $40 Borrowed for 21 Months

End of Month	Payment	Months It Was Borrowed
1	40	1
2	40	2
3	40	3
4	40	4
5	40	5
6	40	6
	240	21

6. $I = PRT, \quad 30 = 40\,R\left(1\frac{3}{4}\right), \quad R = 42.86\%$

3. Play the tape of the demonstration and discuss the types of questions that were asked and the questioning procedures that were used.

4. Divide the trainees into two equal groups: A and B. Give Group A Trainee Sheet 19. Ask them to study the lesson. Give Group B Trainee Sheet 20. Ask them to study the lesson. Help each group member with his lesson, if necessary. Form dyads with one member from each group and have them each tutor their lesson in various parts of the room. After each person has had the opportunity to practice, select a pair and have them tutor each other in front of the group. Tape them. Then discuss their questions and methods.

   Note: The particular problems on Trainee Sheets 19 and 20 were chosen because their solutions are tricky but readily understandable.

   The solutions are given following the problems.

Trainee Sheet 13.

Title: Suggested Instructional Strategies

Students will seek help in the Math Lab with various types of problems. After the initial introduction and small-talk, it is time to begin the helping process. Your first step is to determine the answers to the following questions:

1. What difficulty is the learner having?
2. Is the learner's problem within my province?
3. What needs to happen for the learner to overcome his difficulty?
4. How can I help the learner succeed but at the same time encourage him to be independent?

The answer to the first question is relatively easy to determine. Ask the student why he came to the Math Lab for help. Although you should assume that the student will answer your question honestly, be careful. You may discover in the course of the help session that the student really came for another reason. Then, you will have to abruptly shift instructional strategies. For example, a student may say that he understands how to solve an equation but just can't seem to get the right answer for a particular equation. In reality, he may be looking for you to teach him how to solve the equation because he cut class during the week that it was taught.

Assume that you ask a student to describe his problem and he makes the following responses. Briefly describe your answers to Questions 2, 3, and 4.

1. My teacher doesn't know how to teach. I want to get out of his class. How do I do it?

2. I had a fight with my girlfriend. Now I can't study. Teach me how to solve an equation.

3. I don't understand anything we are doing in class.

4. How do you solve this system of simultaneous differential equations using matrices?

5. I solved all of these equations properly but I just can't seem to get the solution to this one. I tried the problem but I must be doing something wrong.

6. I don't understand how to add these fractions. I went to class. I tried the problems. However, I don't seem to be able to even start in an appropriate way.

Trainee Sheet 14.

Title: Suggested Instructional Strategies

Type of Problem:

1. Really no apparent problem - student just wants to chat.

2. Student has problems but cannot decide what they are.

   It is alright to chat or to help a student decide what his problem is as long as no other students are waiting for help. When you are busy, politely excuse yourself in Type 1 and refer Type 2 to the teacher.

3. Personal problems.

4. General academic difficulty or poor study habits.

5. Problems with college regulations.

   Again, if you are not busy you may discuss these types of problems with the student. Be careful, don't get yourself in too deep. You are not a psychologist. Refer the student to a college counselor or to his academic advisor.

6. The student wants to be taught new and unfamiliar work.

7. The student has a problem on material you know nothing about.

   In Type 6 it is not your job to teach new work to the student. You may attempt to teach the material differently than the teacher has taught it. This will lead to confusion. In addition, this type of help will take up too much of your time. It is the teacher's job to teach new concepts and skills. Either refer the student to his teacher or suggest that he read the material in his text and come back with specific questions.

   In Type 7 don't be afraid to admit to a student that you are not able to help him. Refer students with these types of difficulties to his teacher.

8. A student thinks he knows how to do a problem, has worked it through, but just can't seem to get the correct answer.

9. A student doesn't know how to start a particular problem.

These are the types of problems that are your primary responsibility. Remember, it is not your job to attempt to teach students. It is your job to help students solve their own problems by getting them involved in the problem-solving process. In addition, do not do the students' homework for them. Help them with similar exercises so that they may do their own homework.

In Type 8 ask the student to start the problem again on a fresh sheet of paper. You simply listen and encourage him. If he gets totally lost, follow the procedures suggested for Type 9. You should try not to simply read over his work to find his mistake. This is not involvement. In addition, you should not have him read his old work because he is likely to just repeat the same error.

In Type 9 you must determine what the student knows through questioning. Refer him to appropriate material in his text. If possible, help him to work through one of his author's worked out problems. Help him by asking him guiding questions. Choose a similar problem (to the specific problem with which he is seeking help) from his text and see if he can solve it by himself. If necessary, ask him guiding questions. Repeat these procedures as necessary. Ask simple questions at the beginning of a help session to give the student a feeling of success. When the student feels that he is ready, let him attempt to solve his own problem. Be careful. Use procedures that are used in the student's text or that appear in the student's notes. Don't use your own pet procedures.

The strategies followed for Types 8 and 9 should also encourage the learners to attempt to solve future problems by themselves.

Trainee Sheet 15.

Title: The Container Puzzle

Tutoring should offer the students an instructional alternative. In most classes, the student is a passive learner. He sits, listens, and watches. He may get a chance to answer a question or ask a question once or twice during a class. When a student has difficulty learning a particular concept in class, if the tutor uses the same instructional strategy the learner will probably experience the same difficulty. Tutors must offer an instructional alternative; they must get students involved.

Puzzle:

A woman has an unlimited supply of water and two containers _____.

How can she exactly measure _____?

Trainee Sheet 16.

Title: Find the Error - I

Consider:

$$\frac{x-3}{x^2-4} - \frac{3}{x+2}$$

$$\frac{x-3}{(x+2)(x-2)} - \frac{3}{x+2}$$

$$\frac{x-3}{(x+2)(x-2)} - \frac{3}{(x+2)} \cdot \frac{(x-2)}{(x-2)}$$

$$\frac{x-3-3x-6}{(x+2)(x-2)}$$

$$\frac{-2x-9}{(x+2)(x-2)}$$

Answer is: $\frac{-2x+3}{(x+2)(x-2)}$. Where is the error?

Trainee Sheet 17.

Title: Find the Error - II

Solve for x:

$$3(2x + 5) + 7 = 4 - 2(3 - x)$$
$$6x + 15 + 7 = 4 - 6 + 2x$$
$$6x + 22 = -2 + 2x$$
$$4x = -24$$
$$x = -6$$

Check:

$$3(2x - 5) - 7 = 4 - 2(3 - x)$$
$$3[2(-6) - 5] - 7 = 4 - 2[3 - (-6)]$$
$$3(-17) - 7 = 4 + 18$$
$$-58 = 22$$

x = -6 appears to be incorrect. It does not check. Where is the error?

Trainee Sheet 18.

Title: Questioning as an Instructional Strategy

Tutors have the responsibility of getting the learner involved in the learning process. One way to "force" learner involvement is to use an instructional strategy that emphasizes the use of questions rather than simply the "giving" of information or the "showing" of how to do something. When properly asked questions can motivate interest and stimulate thinking.

While good questions directly effect student thinking, poor questions can be trivial and misleading. Therefore, the tutor must ask the correct type of question at the appropriate time and in a manner that will stimulate the learner.

Types of Questions

Schmalz[1] suggests that classroom questions are of five types:

1. Rhetorical - The teacher does not expect an answer from the student.
2. Opinion - The teacher asks a student to express how he feels about some point.
3. Procedural - The question deals with classroom management.
4. Lower-Order - The question requires the student to recall a fact, perform a simple operation, or solve a familiar type of problem. It does not require the student to work outside the familiar.
5. Higher-Order - The question requires the student to make a comparison, discover a pattern, draw a logical conclusion. It requires the student to arrive at something new after considering what is known.

[1]Schmalz, R. Categorization of Questions that Mathematics Teachers Ask. Mathematics Teacher, November, 1973, 66(7), 619-626.

The first three types are non-content questions. They are used to set the stage for the learning of mathematical content. Types 4 and 5 separate questions of mathematical content by the level of thinking that they demand.

Examples of Lower-Order Questions

1. Recall a fact - What is the Pythagorean Theorem?

2. Recall a method - How do you find the area of a triangle?

3. Make a simple judgment - Which is a more efficient method for finding the sum of the first ten counting numbers, $1 + 2 + \ldots + 9 + 10$ or $S = \frac{n}{2}(a + l)$?

4. Use a basic formula - What is the mean of 2, 3, 4, and 5?

5. Solve a familiar problem - A man invests part of $10,000 at 5% and part at 7%. How much must he invest at each rate to earn $600 a year in interest?

Examples of Higher-Order Questions

1. Solve a new type of problem after just being shown--

   How do you factor $ax + bx - ay - by$? (Student just learned factoring by grouping.)

2. Interpret meaning - What does it mean to say division is not associative?

3. Note a pattern or principle - Is there something that 3, 6, 15, 27, and 45 have in common?

4. Do an original proof - How do you prove that the diagonals of a rectangle are equal? (Student is doing this for the first time.)

5. Creative thinking - Are there applications for

$$\frac{a}{b} + \frac{c}{d} = \frac{a + c}{b + d} \; ?$$

Questioning Procedures

1. Use a questioning strategy when the student needs to be guided in the learning process.

2. Try not to use questions that require simple yes or no answers.

3. Don't answer your own questions.

4. Don't give too much information in the question.

5. Don't ask the obvious. All questions should require some thought.

6. Indicate when answers are correct or incorrect.

7. Praise correct answers.

8. Don't ridicule wrong answers. Don't be impatient.

9. Phrase questions carefully so that they are understandable.

10. When the learner indicates that he doesn't understand the question, rephrase the question to clarify it. Do not ask the same question again.

11. When the learner answers a question wrong, the tutor should ask the learner to explain his answer. If it is a misunderstanding of the question, clarify the question. If it is a lack of understanding of content, either direct the learner to a source of explanation (text) or ask a question on simpler content.

12. Ask lower-order questions at the beginning of a lesson to establish the level of content that the student knows.

13. Ask higher-order questions near the end of a lesson so that students are required to look for patterns to summarize, to suggest general strategies, and to attempt creative thinking.

14. When a tutee asks for help offer him guidance by asking questions. Attempt to keep your giving of information at a minimum.

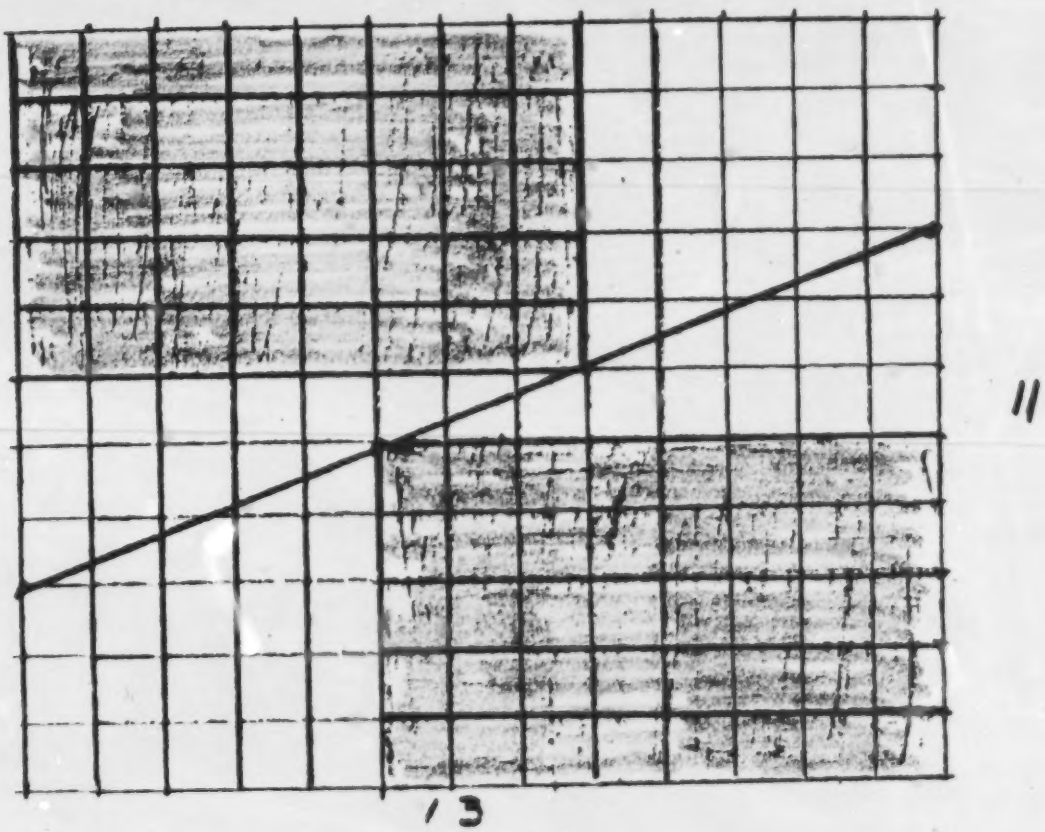
Trainee Sheet 19.

Title: The Extra Square

Consider the Extra Square Grid:

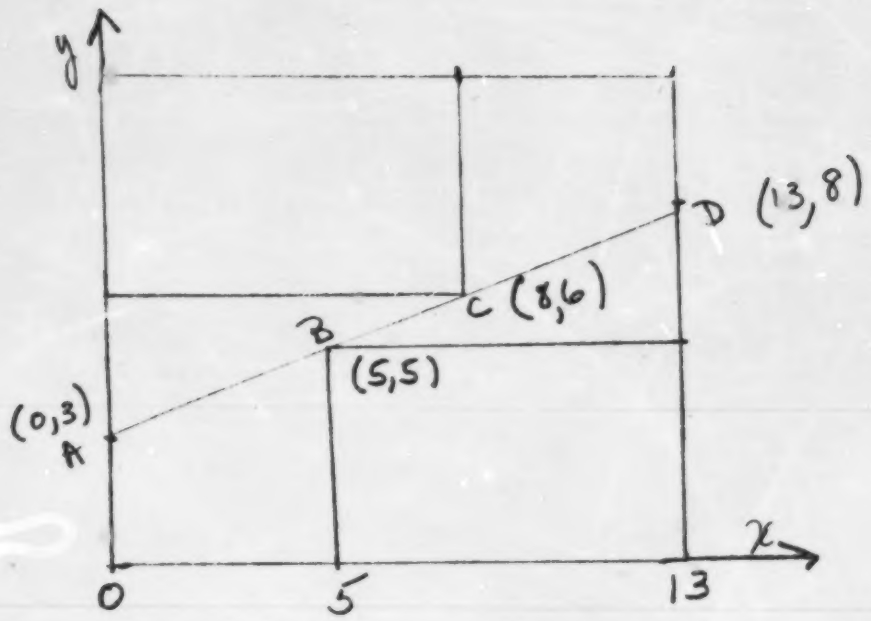
1. The area of the grid is 13 x 11 = 143 squares.
2. Cut out the six pieces and throw away the shaded areas.
3. The remaining area is 143 - 80 = 63.
4. Arrange the four remaining pieces in a square.

5. Where did the extra square come from?



EXTRA SQUARE GRID

Solution of Extra Square Problem:



Points A, B, C, and D do not lie in a line.

$$M = \frac{y_1 - y_2}{x_1 - x_2}$$

$$M_{AB} = \frac{5 - 3}{5 - 0} = \frac{2}{5}$$

$$M_{BC} = \frac{6 - 5}{8 - 3} = \frac{1}{3}$$

$$M_{CD} = \frac{8 - 6}{13 - 8} = \frac{2}{5}$$

Hence, you cannot form a square with the cut out pieces.

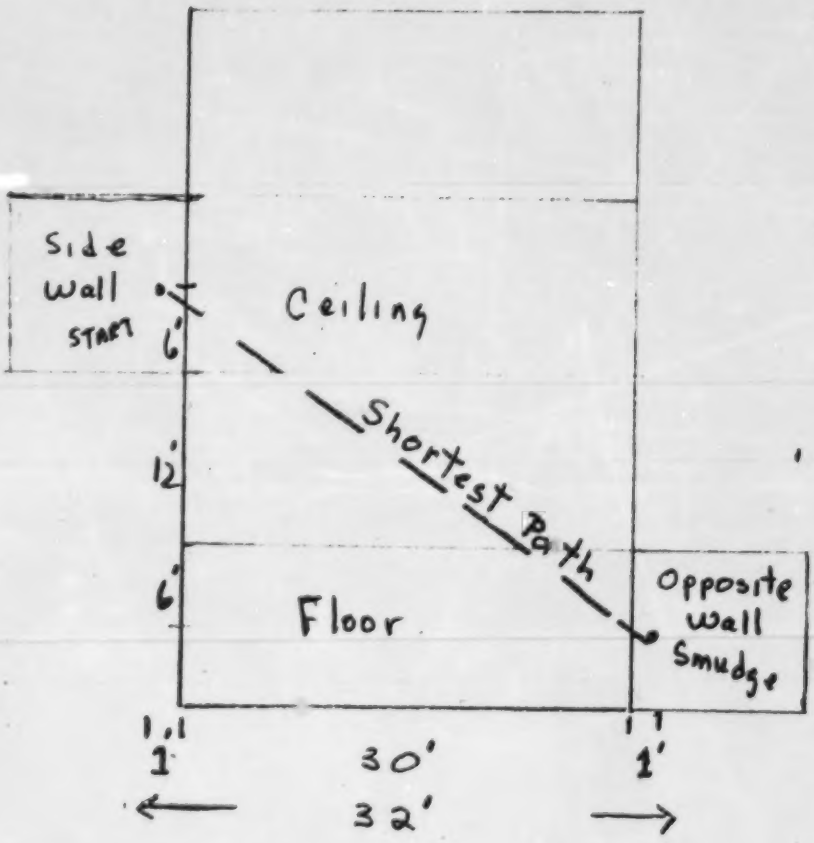
Trainee Sheet 20.

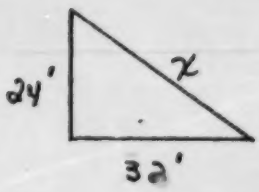
Title: The Shortest Fly Walk

Mr. Smith's living room is 30 feet long, 12 feet high, and 12 feet wide. A fly is standing on a back wall (the wall is 12 ft. x 12 ft.) 1 ft. from the ceiling and 6 ft. from each corner. He wants to walk to a candy smudge (remember, a fly can walk on a vertical wall) which is on the opposite wall 1 ft. from the floor and 6 ft. from each corner. What is the length of the shortest path along which the fly can walk from where he is to the smudge? Assume that he does not have to go out of his way because of doorways or windows.

Solution of the Shortest Fly Walk:

The solution is easy to see if you "flatten-out" the room on a piece of paper.





$24^2+32^2=x^2$

$x=\sqrt{1600}$

$x=40$

LESSON 6. TUTORING PROCEDURES

(Approximate Time: 30 min.)

Exercise 15. A Summary of Tutoring Procedures

Background: The trainees will role-play tutoring a complete session in the next lesson. This lesson is designed to review tutoring procedures and to establish a master list that can be used as a guideline.

Specific Objective: The objective of this exercise is to establish a list of tutoring procedures based upon the guidelines that have been studied in the tutoring sessions.

Agenda:

Activity	Approximate Time	Materials
1. Review of Established Tutoring Guidelines.	10 min.	Trainee Sheets 1-20
2. Discussion: A Master List of Tutoring Guidelines.	15 min.	Trainee Sheet 21
	25 min.	

Lesson Evaluation: (5 min.)

Trainer Notes for Lesson 6.

Agenda (Exercise 15):

1. Ask the students to review their trainee sheets for tutoring guidelines that have been established.

2. Establish a guideline for procedures. Ask for suggestions. Write them on the board. Start at the moment the tutee enters the Math Lab until he leaves. Do not list all of the minute specifics in each category. At the end of the discussion distribute Trainee Sheet 21 and compare suggestions.

Trainee Sheet 21.

Title: A Summary of General Tutoring Guidelines

1. Get to know the tutee--establish a friendly atmosphere.
2. Give the tutee your full attention.
3. Diagnose the difficulty.
4. Decide whether the difficulty is within your province.
5. Establish the instructional strategy.
6. Help the tutee to overcome his difficulty--get him involved.

   Points of Emphasis:

   a. Don't do the tutee's homework.
   b. Be patient.
   c. Give praise--don't criticize.
   d. Give feedback.
   e. Listen.

7. When students are waiting limit your help to 20 minutes with a single tutee.
8. Be sure the tutee experiences some success during the help session even if he does not completely overcome his difficulty.
9. Review, summarize, and evaluate the lesson with the tutee at the end of the help session.
10. Invite the tutee back again.
11. Fill out all the needed records.

LESSON 7. TUTORING PRACTICE

(Approximate Time: As Convenient)

Exercise 16. Tutoring Common Mathematical Difficulties

Background: There are common difficulties that algebra students encounter. For example, problems associated with dividing by zero, radicals, and factoring often cause difficulties.

Specific Objective: The objective of this exercise is to give the trainees practice in helping tutees with common mathematical difficulties so that they may improve their tutoring skills.

Agenda:

Activity	Approximate Time	Materials
1. Role-Play: Tutoring Common Mathematical Difficulties	As long as is available	Trainee Sheets 22 and 23 Deck of Cards

Exercise 17. Tutoring Verbal Problems

Background: Verbal problems frequently cause students difficulties. They will be a popular topic during the tutoring session.

Specific Objective: The objective of this exercise is to give the tutor suggestions on how to approach the solution of a verbal problem and to give him practice tutoring verbal problems.

Agenda:

Activity	Approximate Time	Materials
1. Discussion: Steps in the Solution of Verbal Problems	10 min.	Trainee Sheet 24
2. Role-Play: Tutoring Verbal Problems	As long as is available	Trainee Sheets 23 and 24

Lesson Evaluation: (5 min.)

Trainer Notes for Lesson 7.

Agenda (Exercise 16):

1. a. Assign each trainee an appropriate exercise from Trainee Sheet 22 a few days before the lesson so that he can prepare to tutor.

   b. Select an appropriate tutee to be tutored.

   c. The observers should fill out an observation form (Trainee Sheet 23) for each tutor while he is tutoring and use it for discussion purposes after each lesson.

   d. Keep each lesson to about ten minutes.

   e. Explain "card game" responses to the tutee (Trainee Sheet 22).

   f. If possible, video tape the lesson and play back interesting parts.

Agenda (Exercise 17):

1. a. Assign each trainee an appropriate problem from Trainee Sheet 24 a few days before the lesson so that they can prepare. Note Problems 1-4 are tricky.

   b. Discuss steps for the solution of a verbal problem (Trainee Sheet 24). Use the following problem:

Twenty gallons of a 60% antifreeze solution is to be reduced to a 45% solution by draining some and replacing it with water. How much must be drained and replaced?

2. Have trainees practice tutoring. Use the same procedures as in Exercise 16 except the tutees should behave in a natural manner.

Trainee Sheet 22.

Title: Tutoring Practice: Some Common Difficulties

The following is a list of exercises that algebra students frequently find difficult. Follow the accepted guidelines to tutor the tutee who has approached you for help. Assume that he cannot even start the problem. Since a textbook is not included, you will have to teach using questions.

1. Change 2.39847847847... to fractional form.

2. Subtract: $\frac{x}{x^2 + 3x - 4} - \frac{2}{16 - x^2}$

3. Why is $\frac{3}{x - 2}$ meaningless when $x = 2$?

4. Solve for x: $\frac{x}{x - 1} = 2 + \frac{1}{x - 1}$

5. Is $\sqrt{a^2 + b^2} = a + b$? Why or why not?

6. Is $\frac{x^2 + 9^3}{x + 3} = x + 3$?

7. Is $\frac{x^2 - 9}{x + 3} = x - 3$?

8. Factor: $y^2 - 2xy + x^2 - w^2$

9. Is $x^2 - 14x + 24 = 3$ solved as follows?

$(x - 12)(x - 2) = 3 \cdot 1$
$x - 12 = 3 \quad x - 2 = 1$
$x = 15 \quad x = 3$

10. If $\sqrt{\frac{16}{x^2}} = \frac{4}{x}$, does $x = -2$?

11. Solve for x: $\sqrt{x + (x - 2)^2} = 4$

12. Find the sum and the product of the roots of $2x^2 + 3x + 6 = 0$ without solving the equation.

13. Use logarithms to find x when $x = (0.0942)^{1/3}$.

14. Rationalize the denominator: $\frac{2}{\sqrt[3]{12xy^5}}$

15. Graph: $y = 2 \sin \frac{1}{2}x$ and $y = \frac{1}{2} \sin 2x$.

16. Graph: $y = x^2 - 2x + 4$.

Directions for the Tutee:

When the tutor asks you a question pick a card from the deck. If it is:

1. A - 9, do what you would naturally do.
2. 10 - J, purposely answer the question incorrectly.
3. Q , tell the tutor that you don't understand the question.
4. K , tell the tutor you don't know the answer to the question.

Don't show the tutor the card that you picked.

Trainee Sheet 23.

Title: Tutor Observation Form

	Yes	No
1. Does the tutor attempt to establish an atmosphere to promote learning?		
a. at the beginning of the meeting?	___	___
b. during the meeting?	___	___
c. at the end of the meeting?	___	___
2. Does the tutor attempt to diagnose the tutee's difficulties?	___	___
3. Does the tutor use an appropriate instructional strategy?	___	___
4. Does the tutor implement the instructional strategy properly?	___	___
5. Does the tutor help the tutee to experience some degree of success?	___	___
6. Does the tutor end the session properly?	___	___
7. Does the tutor fill out the appropriate records?	___	___

Overall Tutor Strengths:

Improvements that are Needed:

General Comments:

Trainee Sheet 24.

Title: Tutoring Practice: Verbal Problems

Many algebra students experience difficulties solving word problems. The following are some suggested steps to follow to solve a verbal problem.

1. Read the problem carefully.
2. Read the problem again and jot down the essential given information.
3. Decide what you are attempting to find.
4. Use one or more variables to represent the unknown quantities.
5. Write an equation stating the relationship given in the problem.
6. Solve the equation.
7. Check the answer in the problem statement.

If you have difficulties setting up the problem try:

1. Relating the problem to similar problems that you know how to solve.
2. Try drawing pictures.
3. Check to see if you have used all the data.
4. Try guessing at an answer and work backwards.

Follow the accepted guidelines to tutor a student who has approached you for help. Assume that he cannot start the problem. Since a textbook is not handy, you will have to teach by questioning.

1. Joe lives in Middleville and works in Centerville. Bill lives in Centerville and works in Middleville. They usually leave their homes at the same time. Joe drives twice as fast as Bill and they usually pass each other at Harry's Hot Dog Stand. One day Joe left five minutes late and they passed each other at a gas station, two miles from Harry's Hot Dog Stand. How fast do they drive?

2. A contractor estimated that one of his two masons would take 9 hours to build a certain wall and the other 10 hours. When they work together, 10 fewer bricks got laid per hour, because the men talked to each other. When both men were put on the job, it took the men 5 hours. How many bricks did the wall contain?

3. Bill, who is always in a hurry, walks up an upgoing escalator at the rate of one step per second. Twenty steps bring him to the top. The next day he goes up at two steps per second and reaches the top in 32 steps. How many steps are in the escalator?

4. A man was rowing upstream when his hat blew into the water. Ten minutes later he turned around and recovered his cap one mile downstream from where he lost it. Assume a constant speed and make no allowance for turning around. How fast was the river flowing?

Note: Problems 1-4 were adopted from Litton Industries' "Mathematical Recreations."

5. A ship is traveling toward New York City at 30 m.p.h. It radios that a person is ill aboard ship and must be picked up. A helicopter leaves New York at a rate of 150 m.p.h. when the ship is 270 miles out at sea. How long does it take the helicopter to reach the ship?

6. During the first half the Jets and the Sharks were tied. During the second half the Jets scored 28 points and the Sharks scored twice as many points as they had in the first half. What is the final score if the Jets won by 2 points?

7. Four men decided to equally share the expenses of purchasing a fishing boat. When another man joined the group, the cost to each man was reduced by $100. Find the price of the boat.

8. A chemist has 200 grams of a 20% HCL solution. He wishes to drain some off and replace it with a 60% solution so as to obtain a 25% acid solution. How many grams must be drained and replaced?

9. How long will it take a runner who can run 10 miles per hour to catch up to a runner who can run 5 miles per hour if the slower runner has a 1 mile head start?

10. A homeowner had a supply of oil which he estimated would last him 20 days. However, due to unusually cold weather, he used an additional 5 gallons of oil per day. Because of the additional use, the supply only lasted 15 days. How much oil was in the supply when the estimate was made?

11. It costs a woman 12¢ per mile to drive her car to and from work each day. The round trip is 30 miles. A round trip by bus costs 80¢. If she works 20 days per month, how many days can she drive to work if she plans on spending no more than $27.50 per month for transportation?

12. A pool can be filled by an inlet valve in 10 hours and emptied by a drain in 12 hours. How long will it take to fill the pool if the drain is open when the inlet pipe is opened to fill an empty pool?

Directions for the Tutee:

Let the tutor help you by asking questions. Behave in a natural way.

LESSON 8. STUDY SKILLS

(Approximate Time: 35 min.)

Exercise 18. Suggested Study Procedures

Background: Tutors should try not to push advice on tutees. They especially don't want to hear how poor their study skills are. However, if the tutor is asked for advice, he should respond with simple suggestions.

Specific Objective: The objective of this exercise is to familiarize the trainees with appropriate study procedures that they may suggest to tutees when they are asked for advice.

Agenda:

Activity	Approximate Time	Materials
1. Brainstorm: Appropriate Study Procedures	10 min.	Trainee Sheet 25
2. Discussion: Suggested Study Procedures	20 min.	Trainee Sheet 26
	30 min.	

Lesson Evaluation: (5 min.)

Trainer Notes for Lesson 8.

Agenda (Exercise 18):

1. Let trainees brainstorm by themselves on Trainee Sheet 25. Then, write suggestions on the board.

2. Discuss suggestions on Trainee Sheet 26. Have trainees verify suggestions made in Step 1 or modify their suggestions.

Trainee Sheet 25.

Title: Appropriate Study Procedures

Assume that during a conversation with a tutee he makes one of the following comments to you. How would you respond?

1. I can never get outside help with my homework. I work on my homework on Tuesdays at around 11:00 P.M. for my 8:00 A.M. class on Wednesday. What should I do?

2. I always have to cram for exams. Is there anything I can do? I hate to cram.

3. I read my text carefully. I read over the author's problems. On a test, I miss the same problems. How do you study from a text?

4. My teacher, the louse, gave us the same problem on a test that he did for homework. I couldn't do it for homework and I couldn't do it then either. How can I avoid that problem?

5. My final exam is coming up in a few weeks. How should I go about studying for it?

6. I often have questions during class, but I'm afraid to ask them. What do you do when you have a question?

Trainee Sheet 26.

Title: Suggested Study Procedures

When you are asked for advice on how to study math, you should emphasize regular class attendance, asking questions in class and doing every homework problem "eventually." The following are some suggested procedures:

1. Go to class regularly. When you have a question, be assertive and ask it. Make sure that you understand the answer.

2. Try taking notes on how your teacher works out problems so that you can use them as a model for assignments.

3. Do your homework as soon as possible after class so that if you have difficulties you can get help. If you are completely dumbfounded, try to see your teacher for help. If you just have a few questions, use the Math Lab. If necessary, get help from a friend. If necessary, ask questions at the beginning of the next class.

4. Try not to go into a class without your homework (the one that is due) just about completed. If it is not completed, finish after class. Never neglect a problem.

5. When you read a textbook, read with a pencil. Work out the author's examples as you go. Get help with difficulties.

6. If you keep up with assignments, you will not have to cram for tests. A few days before a test, try reworking (not simply reading over) old assignment problems. Compare your work to your previous work. Study definitions and principles. Test yourself.

7. After a test, correct it. Be sure that you understand all errors.

8. Use old tests and assignments to study for a final. Start reviewing in advance a little each day. Read with a pencil.

Other Hints:

1. Don't try to study when you are tired.

2. Keep up with your sleep.

3. If you are tired when you are studying, you will be probably better off to go to sleep.

4. If you are having difficulty with a problem, stop working on it. Try it again a little later.

5. Work for short periods (one or two hours) at a time. Don't cram for hours.

LESSON 9. LEARNING AIDS

(Approximate Time: 35 min.)

Exercise 19. The Use of Learning Aids

Background: The Math Lab contains three types of study aids:

1. Resource Texts - The tutors can use the texts as a resource for practice exercises.
2. Algebra Tapes and Manuals - The faculty will suggest to students that they use certain tapes and manuals. The tutor simply must hand the materials to the student.
3. Programmable Calculator - The calculators can be programmed to automatically give the user practice exercises. The faculty will suggest to students that they use the programs. The tutor must show the student how to use the machine.

Specific Objective: The objective of this exercise is to familiarize the trainee with the use of the learning aids that are based in the Math Lab.

Agenda:

Activity	Approximate Time	Materials
1. Discussion: How to Use the Learning Aids	10 min.	Appropriate Manuals
2. Tutor Practice	20 min.	
	30 min.	

Lesson Evaluation: (5 min.)

Trainer Notes for Lesson 9.

Agenda (Exercise 19):

1. The trainer should point out how the trainees will become involved with using the learning aids.

   a. The trainer should simply point out the location and availability of reference texts.

   b. The trainer should show the trainees the location of the algebra tapes and explain their use.

   c. The trainer should show trainees the location of the calculators and programs and show them how to operate the machines.

2. Each trainee should practice using the tapes and use the calculators.

LESSON 10. TUTOR DISCUSSIONS

(Approximate Time: As Needed)

Exercise 20. Group Discussions

Background: During the actual tutoring process the tutors will encounter problems or interesting situations. The sharing and discussion of problems and interesting situations will benefit the tutors and help improve the tutoring program.

Specific Objective: The objective of this exercise is to offer the tutors the opportunity to share their experiences so that all tutors can improve their tutoring skills and there can be improvement in the general operation of the tutoring program.

Agenda:

Activity	Approximate Time	Materials
1. Discussion: Tutoring Problems and Interesting Experiences	3 One-Hour Sessions	

Exercise 21. Tutor Observation and Evaluation

Background: Each tutor should be observed by the trainer during an actual tutoring session so that specific suggestions for improvement can be made.

Specific Objective: The objective of this exercise is to observe tutors so that suggestions can be made for improvement during a private evaluation session.

Agenda:

Activity	Approximate Time	Materials
1. Observation of Each Tutor	As Needed	Form 11
2. Evaluation Discussion	As Needed	

Lesson Evaluation: (5 min.)

Trainer Notes for Lesson 10.

Agenda (Exercise 20):

1. Give the tutors opportunity to discuss problems they face. Let the group attempt to suggest solutions.

Agenda (Exercise 21):

1. Observe each tutor during an actual session. Inform the tutor that you will be observing him before the session.

2. Discuss your observation with the tutor. Evaluate his skills and offer suggestions for improvement. If necessary, observe and evaluate the tutor a second time.

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